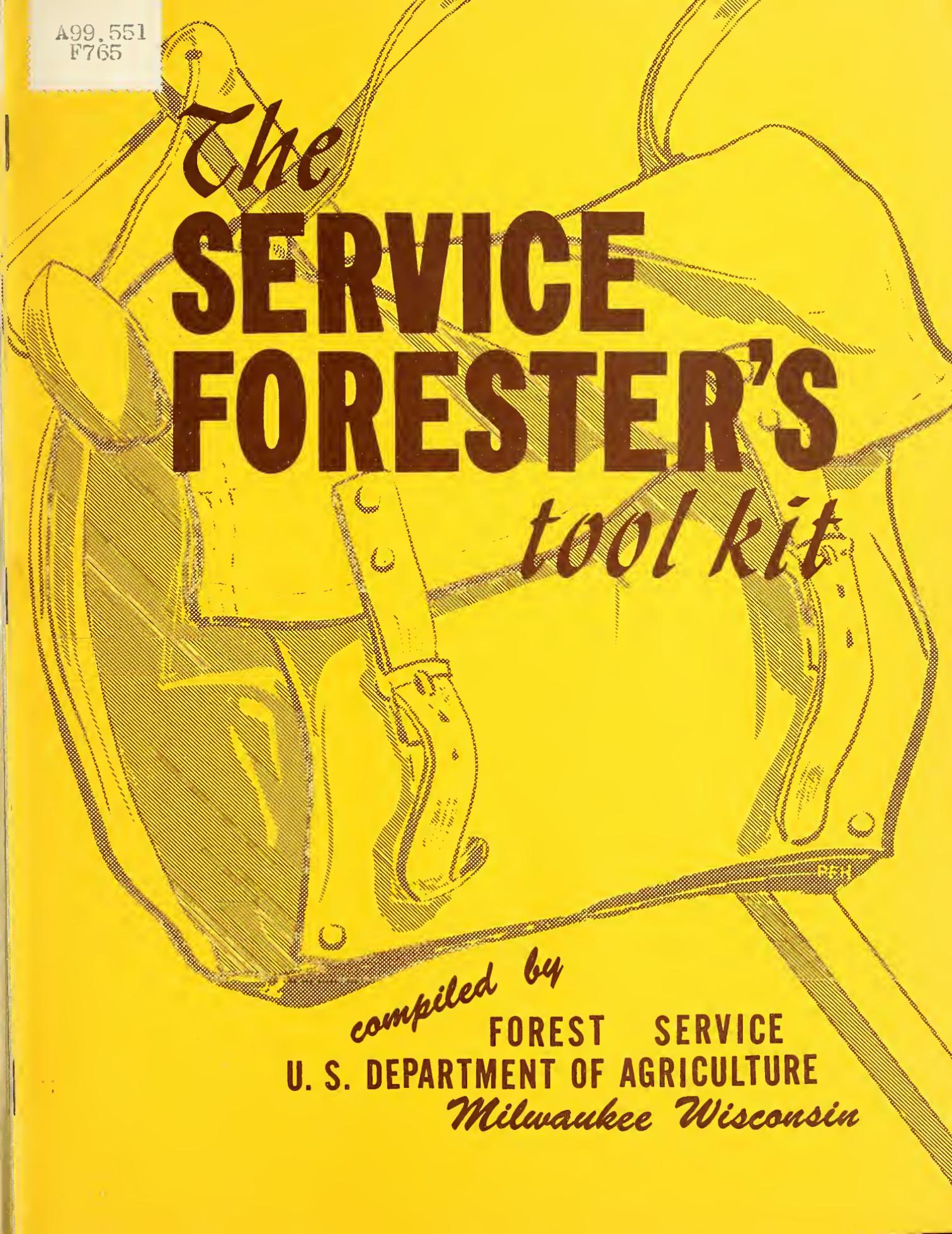


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A99.551  
F765



*The*  
**SERVICE  
FORESTER'S**  
*tool kit*

*compiled by*  
**FOREST SERVICE**  
**U. S. DEPARTMENT OF AGRICULTURE**  
*Milwaukee Wisconsin*

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THE  
SERVICE FORESTER'S  
TOOL KIT



Forest Service - Region 9  
U. S. Department of Agriculture

In cooperation with  
The North Central States

Milwaukee, Wisconsin

April, 1957



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I

WORK PLANNING



## I

## WORK PLANNING

Organizing the work

## 1. Develop clients for services through:

Making contacts with woodland owners, timber buyers, mill owners and other key individuals.

Collection of basic facts on markets, prices and demands.

Cooperation with other agencies, public and private.

Inform public of services offered through news releases, talks at group meetings, showing movies and slides.

## 2. Become familiar with required records.

Wall map showing resource and markets.

Markets list.

Case records.

Field tallies	)	
Summary sheets	)	stapled to back cover of case folder.
Recommendations	)	

Follow-up stapled to front of case folder.

Correspondence, loose in folder.

Promise card record of cases.

## 3. Take action on requests for aid.

Prepare work plan showing priority jobs for each season.

Prepare the week's work for maximum contact and minimum travel.

Make personal contacts to determine facts on needs or problems.

Perform necessary field work to solve the situation.

Make analysis of growth and value of woodlands.

Recommend action to be taken.

Post the wall map.

Make promise card for future follow-up.

## Basic records

### 1. Wall map.

A wall map composed of county maps on a half-inch or one-inch to the mile scale and showing roads in detail can be mounted, singly or as one large map on a piece of fiber board using rubber cement or shellac. With colored pins and small tabs this map can be used to show field operations, location of material for sale, and markets. It is especially valuable when districts change hands and it creates an impression of business-like operation on visitors, both without and within the organization.

On the map tabs the following information can be shown for each case:

Year of analysis ('55).

Volumes on total acreage:

Harvest stock.

Operating stock.

Annual growth of trees 12 inches and over.

Sample tab

		H = 36 M
		'55
AG = 3 M		O = 39 M

H = Harvest stock    AG = Annual growth    O = Operating stock

Once the maps are prepared and brought up to date, very little time is required for maintenance. The more current a wall map is kept, the less time it takes to maintain and the more useful it becomes. A few minutes each week will take care of the necessary changes.

### 1a. Work maps.

County ownership maps are helpful for locating woodland owners in the field.

## 2. Case records.

A convenient device for keeping a record of service rendered in each case is a case file folder. A separate file folder is prepared for each individual served. This is filed permanently in alphabetical order by counties. If desired, a cross-index by geographical location can be used. The case folder contains correspondence, record forms, field tally sheets and the forester's recommendations.

Records of markets, sawmills, available timber and accomplishment are time-saving references for the forester in providing prompt service to his customers. A 5 x 8 card record is used for this purpose by many foresters.



## II

### WOODLAND ANALYSIS



## II

## WOODLAND ANALYSIS

What the analysis shows

Before preparing a management plan, it is necessary for the forester to obtain from the owner his ideas, plans, problems, and requirements in regard to the woodland. With this information the forester can analyze the woods and with the data obtained, determine how the woodland can best be managed under good forestry practices to produce the most value from the property consistent with good forest management and the owner's needs.

The data which can be obtained from a survey of the woods provide definite figures which are necessary to determine and sell good forest management to the owner. A great deal of talk in generalities can be very unconvincing to an owner. It is essential that the sales points be applied directly to the conditions as they exist in the owner's individual woodland. The method of woodland analysis which is described here will give the necessary information to determine proper forest management.

The following information can be obtained by the analysis:

1. Volume of timber which has a good rate of growth and which should not be recommended for cutting. (Good growing stock.)
2. Volume of timber which is growing but at a declining rate. (Operating stock.)
3. Volume of timber which is economically mature and should be cut as soon as possible consistent with the requirements of the owner and the woodland. (Harvest stock)
4. Number of cull trees.
5. The annual growth on the woodland (based on the good growing stock only).
6. The allowable annual or periodic cut (determined from Nos. 2, 3 and 5 above).
7. The value of the growth of the woodland per acre per year, as stumpage, as logs, or as products.

8. The earning value of the woodland to the owner based on the value of the growth as obtained in No. 7.
9. The value of the volume to be cut, as stumpage, as logs, as home use, or as lumber for sale.
10. The value of the stand remaining and the interest rate it is earning for the owner.
11. The amount of fuelwood available for home use or sale.

The first use which develops for these data is their value in convincing the owner that he should follow good forestry practices. The analysis gives us the rate of growth per acre and the volume of the material which can properly be cut from the woods. Knowing the volume of timber which can be cut, it is next necessary that we know the plans of the owner in regard to his timber needs and the possibility of his doing the harvesting himself. For any individual case the data obtained from the analysis are fitted to the needs of the owner as closely as the woodland capabilities will permit, and the recommendations for management of the woodland are prepared on that basis.

#### Making the analysis

1. Preliminary to making the contact.

Determine from the owner the legal description of his land. Before contacting the owner make a sketch map of the woodland from the latest aerial photos available in either the offices of the ASC or the SCS. On this sketch trace the boundaries of different condition classes that are discernible on the photos. This does not require past photo interpretation experience. After checking a few such sketch maps on the ground and then again referring to the aerial photos, one soon becomes able to distinguish the differences between the timber condition classes. Contact prints should be used, where available, as the enlargements made from contact prints are usually blurred and difficult to interpret. It is not necessary to attempt to tell from the photo what the condition classes consist of, but only to be able to trace the boundaries between condition classes so that the location and area occupied can be determined. Very often on small woodlands of less than 40 acres there will be only one timber condition class. Very rarely will there be more than three classes present. Timber condition classes vary by changes in forest type, size of timber, density of timber, site and topography. If differences in condition classes are visible on an aerial photo such dif-

ferences can usually be recognized on the ground by observation.

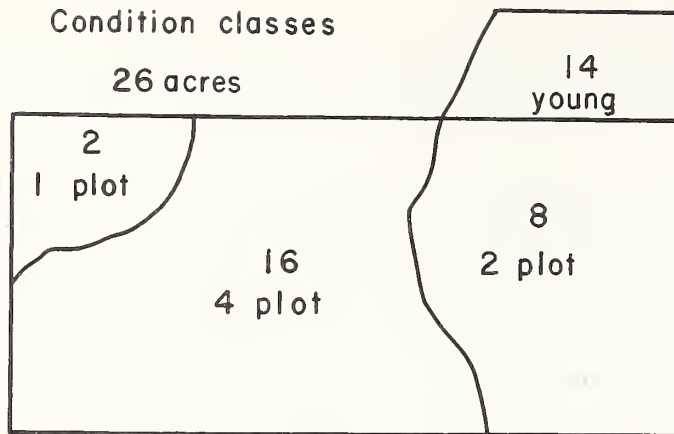
## 2. Preliminary to the cruise.

Visit the woods with the owner, walk through it to determine its general condition, the timber types, and size classes represented, and kinds of products which can be grown and harvested. Check the relative area and location of the different timber condition classes represented, and make any necessary corrections on your sketch map of the woodland.

The plots are allocated to the timber condition classes on a weighted acreage basis. If the acreage in the smallest condition class is 5 acres or less, it is cruised as a unit by itself. The next smallest timber condition class in the balance of the woodland is then used as an index for the number of plots to be allocated to each condition class.

Areas of young timber with little or no merchantable volume should not be included in the estimate of the merchantable timber. If such areas are included the average stand per acre obtained by the cruise will in no way resemble the stand as it actually exists on the ground. More accurate results will be obtained if areas of young growth are eliminated from the cruise. These areas should, however, be carefully looked over to determine if any stand improvement work should be recommended. If the young stand is nearing merchantability a separate tally of a plot or two should be made to determine the approximate degree of stocking and growth rate so that the owner can be advised as to the earning value of the stand and the length of time it will require to reach merchantable size. In the example below the 14 acres of young timber illustrate this point.

For example - A 40-acre woodlot has been found to contain 14 acres of young timber (2" to 10") not merchantable, 16 acres of medium-sized merchantable timber, and 8 acres of large-sized bottomland timber. As there is little or no merchantable volume in the 14 acres of young timber, these 14 acres are deleted from the cruise, leaving 26 acres to consider:



The smallest condition class in merchantable timber size is less than 5 acres, therefore, it should be cruised as a unit by itself. The next smallest condition class in the balance of the woodlot is 8 acres. In this example, two plots are allocated to the 8-acre condition class. In order to maintain the same ratio of plots to acres, four plots are allocated to the 16-acre condition class. Whatever number of plots are taken, they should be properly proportioned between the timber condition classes based on the relative acreage of the woodland represented by each class.

For woodlands larger than 80 acres it is usually best to sample each timber condition class separately, taking from two to three plots in each class, keeping the tallies separate, and applying these tallies to the acreage in the respective timber condition classes.

#### Tools commonly used:

Canvas carrier case	Cruiser (Biltmore) stick
Box compass	5" x 9" tatum holder
Diameter tape	Increment borer
Belt axe	1/5 acre circular plot tape, (52.7 ft. long) *

\*Other circular plot radii: 37.2 feet for 1/10 acre;  
26.3 feet for 1/20 acre; 16.7 feet for 1/50 acre;  
11.8 feet for 1/100 acre.

### 3. Locating plots.

The walk through the woods, winding up at the far end, need not be considered as wasted time, as you can start your cruise from that end and wind up at the point of entry. Using your

sketch map, mark the approximate location of the plots you have allocated to the various condition classes. Some foresters prefer to spot the location of their plots from the aerial photos before they go to the woods. Locate yourself on the map, and proceed to the edge of the timber condition class to be sampled, or until you are within two or three chains of the estimated plot location. Then start pacing a fixed chainage which should not be less than two chains, as this procedure is used to eliminate personal selection of the plot centers. A guide mark or compass bearing should be used when doing this pacing so that the direction is not changed during the pacing. When the predetermined distance has been paced out the plot tape should be tied to the nearest small tree capable of withstanding the pull on the tape. This is the plot center.

Subsequent plots are located by determining the general direction to the next plot and scaling or estimating from the sketch map its distance from the plot just completed. Pace out this distance on the proper bearing to determine location of the next plot center. It is more essential that the plots be taken in their proper timber condition class than it is that their location be exactly as indicated on your sketch map. Therefore, if you find in arriving at your next plot location that it is outside of the timber condition class because of error in your pacing or direction, move it the necessary distance to place it in the condition class which it should sample.

The plot location should also be changed when any unusual feature in the woodland falls within its boundaries. Unusual features may consist of extremely large trees not characteristic of the large-size group in the woodland; a group of trees of one species not generally present throughout the woodland; a small burned area which has an extreme amount of defect from fire; a small pocket of blown-down timber; etc. When moving the plot centers to avoid unusual features, move it far enough to place it outside the influence of the feature being avoided. For instance, if the trunk of an extremely large tree is but a few feet outside the plot boundaries, a good share of the plot may be affected by its large spreading crown.

If the unusual feature avoided on the plot has a particular value or significance for the woodland, a 100% tally or separate study of it should be made.

#### 4. Classification of trees.

In the procedure being recommended for the analysis of a woodland, no cut and leave cruise is made. Instead, the trees making up the stand are divided into four groups - good growing stock, operating stock, harvest stock and cull stock. For the purposes of this segregation, the physical condition of each tree on a plot is examined. This segregation of the growing stock does not take into consideration the quality of the sound material in a tree, the value of the wood, the economic conditions which prevail locally, the silvicultural requirements of the trees, nor the volumes which might be cut or left. Instead, the stock is divided into four groups as nearly as can possibly be done, with the knowledge at hand, solely on the basis of whether or not each tree is putting on a net growth, standing still, going backward in volume, or less than 50% sound. The total of the net growth for all the good growing trees is the growing capacity of the stand.

When the volume of the good growing stock, the volume of the material in operating stock, the amount of harvest stock and the number of cull trees have been ascertained, the forester knows what should be done to place the stand under good management. If the forest is understocked, as so many are at this time, it is obvious that none of the good growing trees should be cut. To do this would further reduce the growing capacity of the woods. It is not unusual to find that present day stands may have 50% or more of their volume in the two poor-growing stock classifications. It would be poor management to cut more than 50% of the volume in a stand already understocked. Therefore, it is necessary for the forester to know how much of the poor growing stock to take out. This information is given him by the volumes tallied in the harvest material classification. The harvest material should be cut as soon as possible. The operating stock can be held for several years or cut now, depending on the requirements and needs of the owner, markets and the silvics of the woodland. There are a few, but very few, woodlands which have been properly managed in the past; it would be only in such woods that it would be good management to cut good growing stock trees, and this would be only when the woods were fully stocked.

If all the trees in a cruise of a woods which are putting on a net growth are grouped in tallying, we can tell, in working up the data of the cruise, the number of such trees, their average d.b.h., and their average usable height. If we take an increment boring on each plot covering the predominant species of the stand

we can determine fairly accurately the average number of years it takes these species to grow an inch in radius. These data, the number of good growing trees 12" and larger d.b.h., the average diameter of these trees, the average usable height, and the average number of years to grow an inch in radius can be used in a simple formula, shown on the reverse side of the tally sheet (See Page No. 39) to get the growth per acre per year of the timber. To the growth of the trees 12" d.b.h., and larger must be added the ingrowth from 10" d.b.h. trees which will grow into the 12" size class within the period it takes to grow 1 inch in radius. The good growing 10" trees are therefore also tallied with the good growing stock. Their number per acre is used in a simple formula (on tally sheet) with the growth data obtained from the borings to determine the volume of this ingrowth.

The growth rate having been determined, the permissible cut can be figured by allowing a percentage of the growth to go toward building up the stand and the permissible cut consisting of the remainder of the growth. When the volumes of the four classes of trees in a woods are known, the volume which should come out without over-cutting the stand can readily be determined by the forester. He must then take into consideration the prevailing economic conditions, such as the local markets, the owner's own needs for forest products, the possibilities of getting the owner to harvest the trees himself, and the possibility of making a commercial operation. The ideal arrangement from every viewpoint is to get the owner to operate his own timber on an annual or short interval cropping basis; the next choice is to get an operator who will harvest the trees on an annual basis, or even a periodic basis of from three to five years between cuts. The last resort should be the commercial operator who takes so much volume in one cut that another cut cannot be made for 10 or more years.

The following outline breaks down the various thrift and effect characteristics into the four classifications mentioned above. Foresters are familiar with these characteristics and after a little practice in the woods they have little difficulty in getting the trees placed in the right classification.

### Characteristics for Classification

#### 1. Good growing stock (5% cull).

##### a. Thrift characteristics.

- (1) Dominant or co-dominant crown position.
- (2) Limbs healthy or only one large (6" or larger) and a few small (less than 2") dead limbs present. The large dead limb allowed should not be in the top of the merchantable length.
- (3) Foliage dark green, dense, leaves normal.
- (4) Trunk usually perpendicular, although leaning of trunk allowable if roots have not been sprung.
- (5) Root free of defect - showing no evidence of having been badly sprung.

##### b. Defect characteristics.

- (1) Ingrown bark allowed.
- (2) Sound burls allowed.
- (3) Small broken or dead limbs 2" or less in diameter allowed on trunk.
- (4) Small tight seams less than 6' long allowed.
- (5) Small crack, scar, or small sealed limb swell allowed.
- (6) Slight crook or sweep allowed if it will cut out.
- (7) Small surface injuries on the butt allowed.

Trees in the above class are mostly free of defects and generally thrifty, so the volume tallied in this class need be culled only 5% for net volume. All things being considered the trees placed in this class should be capable of remaining thus classified for 10 years. If 4 or more of the above minor defects occur on the same tree, the tree should be classified in the following class.

## 2. Operating stock (10% cull).

### a. Thrift characteristics.

- (1) Crown may be dominant, co-dominant, or intermediate in position in the crown canopy.
- (2) Two large and several small dead limbs allowed in crown or near the top of usable length.
- (3) Foliage healthy to slightly yellow leaves, smaller size than normal.
- (4) Trunk may be leaning if roots not sprung.
- (5) Roots may be slightly defective but should not be sprung to any appreciable extent.
- (6) Overly large trees on average sites should be placed in this class even though thrifty and sound. See explanation following this outline.

### b. Defect characteristics.

- (1) Sweep or crook allowed if loss is less than 15% of tree volume.
- (2) A large tight or healed seam allowed.
- (3) Large scars and large limb swells allowed if completely healed over.
- (4) Several broken or dead limbs allowed on lower trunk if not larger than 2" in diameter. Larger dead limbs and small holes allowed on trunk if they occur near top of merchantable length.
- (5) Small injuries of recent origin to roots or trunk allowed. (One to five years old.)

The cull deduction for this class of trees averages 10% of their gross volume. All things being considered the trees placed in this class should be capable of remaining thus classified for a period of 10 years. If four or more of the above minor defects occur on the same tree, the tree should be classified in the following class.

## 3. Harvest stock (25% cull).

### a. Thrift characteristics.

- (1) Crown may be dominant, co-dominant, intermediate or suppressed.
  - (2) Two or more large dead or broken limbs in crown (6" or larger). Spike tops.
  - (3) Foliage unhealthy in appearance, leaves small, foliage sparse.
  - (4) Trunk may have a heavy lean and roots may be sprung.
  - (5) Roots seriously defective and may be sprung.
- b. Defect characteristics. (If defects cause over 50% deductions, tree becomes a cull.)
- (1) Sweep or crook causing loss of more than 15% of the tree volume.
  - (2) Large open seams.
  - (3) Large open scars, large open limb sockets.
  - (4) One or more large broken or dead limbs on lower trunk.
  - (5) Presence of fruiting bodies of fungi.
  - (6) Large holes on trunk.
  - (7) Butt or heart rot plainly evident or detectable by sounding.
  - (8) Large old or recent mechanical injuries to trunk or roots.
  - (9) Low fork of main trunk, weak crotch, and wolf trees.

Trees classed as harvest material have an average cull of 25%. Individual trees in this class may have cull percents from 0-50%.

#### 4. Cull stock (trees over 50% defective).

The classification of trees in many woodlands has shown that trees usually become poor growing stock (operating or harvest) at or about the following size classes, in the central hardwood region:

<u>Species</u>	<u>DBH</u> <u>inches</u>	<u>Species</u>	<u>DBH</u> <u>inches</u>	<u>Species</u>	<u>DBH</u> <u>inches</u>
White oak	28	White ash	20	American elm	28
Aspen	12	Red elm	22	Red maple	
Hickory	20	Hackberry	22	(on bottomland)	30
Basswood	18	Butternut	20	Cottonwood	30
Sugar maple	20	Northern		Black walnut	30
Black oak	20	red oak	26		

Good forestry practices will no doubt raise the size class to which trees may be profitably grown, but until such time as this can be determined, the above diameters can be used as an indication of maturity or near maturity of the trees of the various species. Under optimum conditions trees will, of course, reach the above diameters and still have many years of good growing life ahead of them. The above diameters are averages over a wide area and should be used as guides only. On good sites trees of these diameters which are thrifty can be classified as good growing stock, but on the average site trees of the above diameters, even though thrifty, should be classified as operating stock on the stump. Defective trees of these diameters, or larger, should, of course, be classified according to their condition, into operating or harvest classifications, the same as defective trees of smaller sizes.

Good growing stock consists of all trees which in the judgment of the forester are putting on a net growth each year. It is not important whether the trees in this class are excellent growers, good growers, or only fair growers, but they all must be making a net growth. A slow growing tree free of all defects would be a net grower, and be classed in the good growing stock. On the other hand, a fast grower with many serious defects would be placed in the harvest class.

We therefore balance thrift characteristics against defect characteristics to guide our judgment in determining whether a tree is putting on a net growth, standing still, or losing in volume.

## 5. Tallying the plots.

The tally sheets shown in the Appendix, or any similar tally sheets giving the same data, should be used in tallying for the analysis. The good growing stock can be tallied on an International scale tally sheet and the other two classifications can be tallied on the scale used locally by industry, buyers, and other market outlets. This procedure gives data close to actual lumber tally for management purposes on the good growing stock, and the data for the operating and harvest stock will be on the scale coinciding with local marketing use. Many foresters, however, prefer to use the same log rule tally sheet for all tree classifications.

A separate tally sheet is commonly used to record each class of timber. Michigan, however, has devised a single tally sheet for all three classes. A summary of the data is on the "Tract Volume Summary" sheet (see Appendix), or a similar form. This summary gives all the data needed to determine the growth and values of the woodland. The formulae and tables on the reverse side of the tally sheet show how the data from the summary sheet are to be used.

In regard to the techniques used in measuring the trees which are familiar to all foresters, the only thing essential to this analysis is to be as accurate as possible. When it is doubtful that a tree is in or out of the plot always measure it with the plot tape. Care should be taken in estimating the merchantable length or height of the trees. This item often causes error in estimates. Check your eye occasionally with the cruiser's stick or altimeter to be sure of your heights. Measure the d.b.h. of all the trees with either the cruiser's stock or, preferably, with a diameter tape. Good cruising, of course, calls for accuracy. If the plots are accurately cruised and properly located you can confidently expect results of sufficient accuracy for management purposes.

It should be remembered that the data from this analysis are not used to determine the volume of timber to be sold. When the marking of the trees is done a marking tally should be made. The volume shown by this marking tally, which is a 100% measurement of the marked trees, is the volume used for sale purposes.

#### 6. Applying data obtained from cruise ("Analysis").

The owner or his representative should always accompany the forester while he is making his cruise. During the course of the cruise, take every opportunity to point out those things which the owner must realize in order to manage his woods under good forestry practices, and for his best interests. Explain to the owner (1) why you measure the trees; (2) why you classify the trees; (3) why you take increment borings; (4) why you tally the cull trees; (5) why you tally the 10" d.b.h. trees; (6) what kind of products can be cut from individual trees; (7) how individual trees can be utilized on the farm; (8) how to eliminate vines; (9) what damage grazing does; (10) what damage fire does; (11) how spot planting can improve stocking; (12) the need for edge protection around the woodland; (13) the effect of forest cover in retarding erosion and run-off; (14) how wildlife uses the forests; and (15) what species are present and how

the brush is composed of valuable trees for the future; (16) importance of woodland for recreation.

At the end of the cruise, leave the owner with the understanding that you will present to him a brief report on the condition of his woodland with your recommendations as to what he should do to manage it properly. You can then compute your cruise in the office and analyze the data you have obtained. Prepare your report using those of the following items which you feel apply to the case at hand, keeping in mind that the report should be as brief as possible, and avoiding the use of technical terms which might confuse the reader. If at all possible, the report should be delivered in person to the woodland owner in order to answer any questions he might have.

#### Outline for report

##### 1. Purpose.

(Example):

(This woodland report has been prepared as a statement to you of the present condition of your timber and to outline the present and future management policies for your future reference.)

##### 2. Objectives of management.

(Example):

(The woodland is essentially the same as the other fields on your farm. Your work in the woodland should be planned the same as for your other fields. Your equipment purchases and use should be planned with the woodland in mind. The recommendations given in this report have been made to enable you to attain the following objectives for your woodland.)

- a. To merge the work of growing and harvesting woodland products into the regular farm plan.
- b. To provide an adequate amount of forest products for home use, such as lumber, fence posts, fuelwood, etc.
- c. To maintain a reserve of timber on hand for emergencies, such as replacing or helping to replace a farm building which has been destroyed by fire or other causes.
- d. To build up the stocking and growth of the woodland to the full capacity of the site and thereby increase the value of the woodland and the farm.

- e. To increase the farm income by providing, where possible, a surplus of timber and other forest products for sale.
  - f. To develop and maintain favorable food and cover conditions for game and other wildlife.
- 3. Description of the stand, area, volume by tree classes, and species.
  - 4. Volume of the stand to be left, its growth, value of the growth, its investment value as a reserve.
  - 5. Volume and value of the timber to be cut, marking rules, allowable cut.
  - 6. Recommendations.
    - a. Protection from fire.
    - b. Protection from grazing.
    - c. Harvesting - by owner or by operator - yearly or periodically.
    - d. Stand improvement, thinning, pruning, or planting.
    - e. Marketing - sale as stumpage, logs or products - list of market outlets, sale contract.
    - f. Site preparation for natural regeneration or planting.
    - g. Other.
  - 7. Future woodland management services.

(Example):

(After you have studied this report I will be glad to explain any points about which you may have questions. Further assistance from the Department of Conservation depends upon your acceptance of good forestry management for your woodland. If the above recommendations are agreeable to you, let me know when you will have time available to assist me in selecting and marking the trees which should be harvested. After the trees are marked I will assist you in finding a market for the products.)

### III

#### PRACTICAL USES OF POINT SAMPLING



## PRACTICAL USES OF POINT SAMPLING

Point sampling is a method of estimating basal area quickly and accurately by merely counting trees without measuring diameters or plot radius. Related data on stand structure, stocking and volumes are easily obtained. This system was devised by Bitterlick in Germany several years ago, but it was not used in this country until recently.

In using this method the forester views the d.b.h. of every tree visible from a set of points selected on the woodland in an unbiased manner. He counts the number of trees around a sampling point that are not cut in two when viewed through a wedge prism. Multiplying the tree count by 10 \* gives the average basal area per acre around the sampling point.

The prism is held in the right hand by lower corner of thick edge. This deviates the section of the tree, as seen through the glass, to the left - away from the thumb.

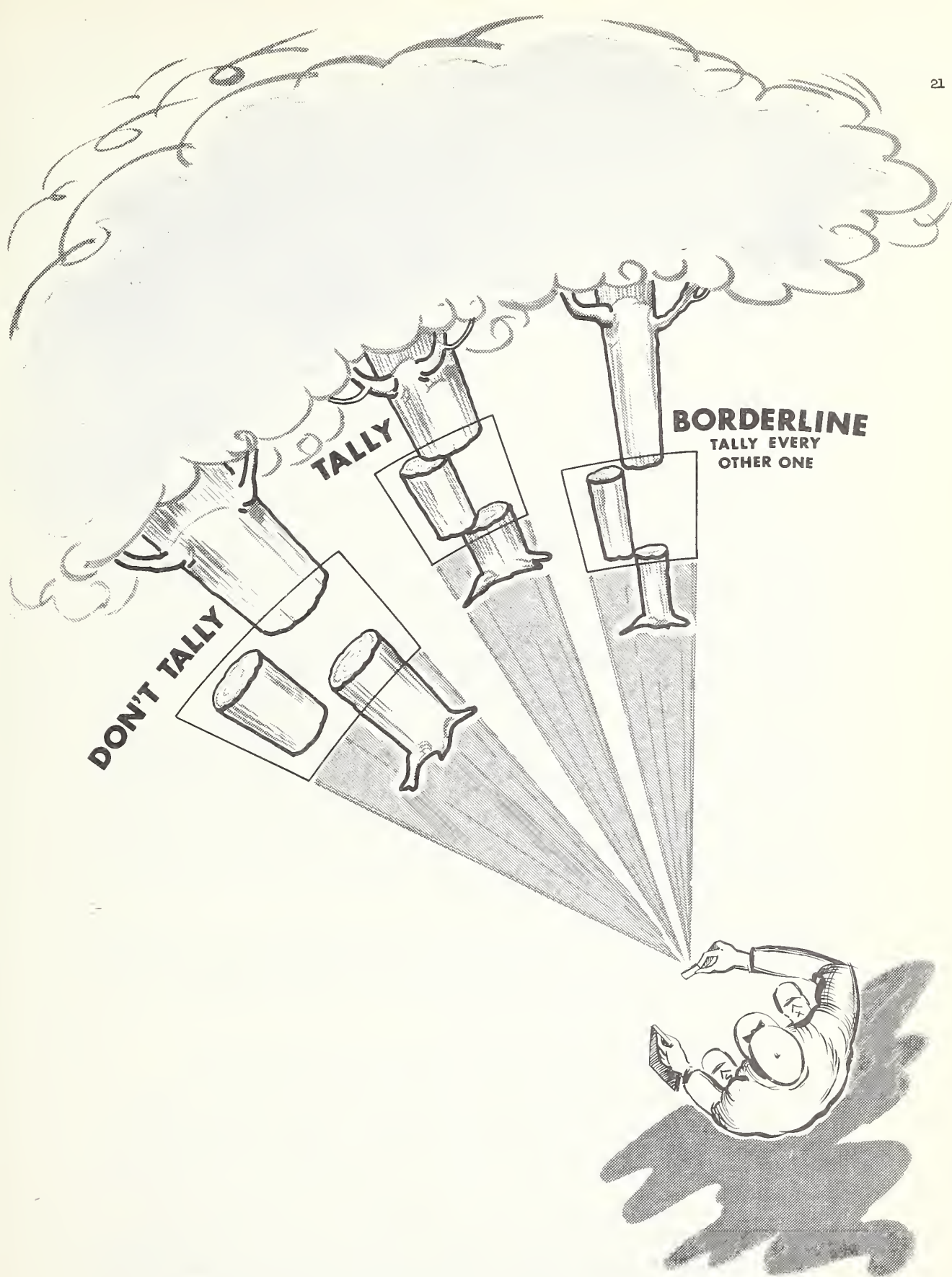
The prism is the point, not the eye of the holder. Therefore, the forester should never revolve on one spot, but should hold the prism over a fixed sampling point as he turns to check all trees around that point. The face of the prism should be at right angles to the line of sight, and on level ground, this top edge should be horizontal.

The formula for slope correction in the use of any simple point-count gauge, stick or prism, in hilly terrain, is to multiply the point-count by the secant of the maximum slope at the sampling point.

SLOPE CORRECTION TABLE		
	Maximum % Slope at Sampling Point	Multiply Point Count By
	15	1.01
	20	1.02
The corrections are	25	1.03
apparently insignificant	30	1.04
on slopes up to 15%.	35	1.06
The significance increases	40	1.08
as slopes become steeper	50	1.12
	60	1.17
	70	1.22
	80	1.28
	90	1.34
	100	1.41

\* An angle of about 10 mils is one prism diopter. An exact 3 diopter wedge prism has a basal area factor of 9.799. Ordinarily, a factor of 10 can be used to get the approximate basal area.

There is a much simpler way to correct for slope than by the slope correction table. The point count is automatically adjusted for slope by lowering or raising the left edge of the prism until the top edge of the prism has the same slope up or down as the sight to the tree, up or down. Thus, in taking a reading on a tree up (or down) a 20% slope, the top edge of the prism should be 20% off the horizontal.



If, for example, the forester has tallied a total of 24 qualifying trees at 3 unbiased sampling points on a woodland:

$$\begin{aligned}\text{Estimated basal area per acre} &= 10 \left( \frac{\text{number of tallied trees}}{\text{number of sampling points}} \right) \\ &= 10 \left( \frac{24}{3} \right) \\ &= 80 \text{ sq. ft.}\end{aligned}$$

\* \* \* \* \*

### Management of Coniferous Plantations or Natural Stands

One of the methods now in use to maintain maximum growing conditions in coniferous stands is basal area control. In order to compare the yields of normal stands with actual stands, the corresponding densities of stocking must first be determined. Probably the most precise measurement of stocking is in terms of the total basal area in square feet per acre of all tree items 0.6 inches d.b.h. and larger.

For example, if the forester is marking a 40-year red pine plantation for a commercial thinning, he will use the Point Sampling system to determine his basal area per acre. Let us say he finds the plantation has an average basal area of 150 square feet per acre. His stocking table for well-stocked managed red pine shows a desirable basal area of 110 sq. ft. per acre. Thus, he knows he should remove 40 sq. ft. of basal area per acre to put the stand in maximum growing condition.

As the forester marks the stand for thinning he can use the point sampling system to check the basal area of marked trees. If the marked trees total over or under the 40 sq. ft. required, he can adjust his marking accordingly.

### A Guide for Timber Stand Improvement in Hardwoods

Nearly all hardwood stands can be benefited by cultural treatment. Such operations improve the general vigor and growth of the woodland by cutting or deadening weed trees, diseased trees, "wolf trees" and other trees that are detrimental to the stand.

In marking a woodland for T.S.I. treatment, the forester will strive to maintain a stocking which will bring about the maximum growth of high-value timber. Basal area values for desirable stocking of hardwood stands are available for most types. Use of Point Sampling will help the forester in his marking to obtain the desirable stocking and stand structure.

### Timber Reconnaissance

Point Sampling offers a fast method of obtaining timber volumes for most species. It is not necessary to measure plot radius, of course, nor is it necessary to measure or estimate d.b.h. The only data needed are the number of 16-foot logs and the number of 8-foot sticks of pulpwood per sampling point.

When a forester makes his initial reconnaissance of a woodland or plantation, he obtains the number of logs or pulp sticks from a few sample points which he selects in an unbiased manner. The average number of 16-foot sawlogs for sampling point multiplied by the appropriate factor\* equals the board foot volume per acre. Likewise, the number of 8-foot pulp sticks per sampling point multiplied by the appropriate factor\*\* equals the cords per acre. Net volumes are obtained by the usual methods of cull deductions by species.

The suggested tally sheets shown on Pages 24 and 25 can be used to tally every merchantable tree by the point sampling method. Under this system, volume per square foot of basal area is dependent upon height classes regardless of d.b.h.

Other adaptations are possible for this form to obtain other information which the forester may wish to obtain for the owner.

\* 600 is the factor which applies throughout most of Region 9.

\*\* .6 is the factor which applies throughout most of Region 9.

## WOODLAND RECONNAISSANCE

## POINT SAMPLING TALLY

Number of Points	Pulpwood								Owner
									Date
									County
No. of Sticks	SPECIES								Total No. of Sticks
1									
2									
3									
4									
5									
6									
7									
8									
Total									

\_\_\_\_\_ Sticks  $\div$  \_\_\_\_\_ Sampling Points =

\_\_\_\_\_ Avg. Sticks per Sampling Point X

\_\_\_\_\_ (Factor) = \_\_\_\_\_ Cords/acre

\_\_\_\_\_  
Forester

## WOODLAND RECONNAISSANCE

## POINT SAMPLING TALLY

Number of Points	Sawlogs	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px;">Owner</td></tr> <tr><td style="padding: 2px;">Date</td></tr> <tr><td style="padding: 2px;">County</td></tr> </table>	Owner	Date	County					
Owner										
Date										
County										
Number of Logs	SPECIES	Total Number of Logs								
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 12.5%; height: 20px;"></td> <td style="width: 12.5%;"></td> <td style="width: 12.5%;"></td> <td style="width: 12.5%;"></td> <td style="width: 12.5%;"></td> <td style="width: 12.5%;"></td> <td style="width: 12.5%;"></td> <td style="width: 12.5%;"></td> </tr> </table>									
1										
2										
3										
4										
5										
6										
7										
8										
Total										

\_\_\_\_\_ Logs  $\div$  \_\_\_\_\_ Sampling Points = \_\_\_\_\_

Avg. Logs per Sampling Point X \_\_\_\_\_ (Factor) = \_\_\_\_\_

\_\_\_\_\_ B. F. per Acre.

\_\_\_\_\_  
*Forester*

# REFERENCES

Arborgast, Carl, Jr. - Basic Principles of Forest Management in Northern Hardwoods.

Paper presented at fall meeting of Northern Hemlock and Hardwood Manufacturers' Association, 1956.

Grosenbaugh, L. R. - Shortcuts for Cruisers and Scalers. Occasional Paper 126. Southern Forest Experiment Station, 1952.

Plotless Timber Estimates - New, Fast, Easy. Southern Forest Experiment Station

Better Diagnosis and Prescription in Southern Forest Management. Southern Forest Experiment Station Occasional Paper, 1955.

Spurr, Stephen H. - Cumulative Basal Area Tally Sheet, No. 17. School of Natural Resources, University of Michigan.

Tomlinson, Harry R. - The Use of Point Sampling for Preliminary Reconnaissance in Hardwood Stands. U. S. Forest Service, Atlanta, Georgia, 1955.

IV

TIMBER-STAND

IMPROVEMENT



## IV

## TIMBER-STAND IMPROVEMENT

One of the important functions of a service forester in meeting the objectives of the program is to secure fully-stocked woodlands of high quality trees.

In order to accomplish this objective it is necessary to give all woodlands periodic improvement treatment. All undesirable trees should be cut, girdled or poisoned to make room for healthy, valuable growing stock.

Type of treatment

Obviously, the type of treatment will vary on different woodlands and must, therefore, be based on the technical decision of the forester on the ground. As a guide the following treatment should be considered:

1. Remove all diseased trees.
2. Remove all trees seriously damaged by insects.
3. "Wolf" trees should come out of the stand when they are suppressing younger trees of high value.
4. Trees so decayed, deformed or crooked that they will never have merchantable value should be removed. (Consider leaving den trees or other trees being used by wildlife)
5. Vines which are seriously damaging valuable trees should be removed.

In addition individual stands may justify the following treatment:

1. Thinning sprout clumps.
2. Removal of trees seriously damaged by fire, grazing or mechanical injury.
3. Removal of low value species that are over-topping and suppressing healthy trees of high value species.
4. Pruning to produce more clear wood on the butt log. (Primarily in pines.)
5. Thinning. (Primarily in conifers.)

Stocking

There is a close correlation between stocking and marking for woodland improvement. Foresters will be guided by the conditions of the woodland. In poorly stocked stands it is necessary to make a series of light cuts over a period of years. In woodlands

that are fully-stocked or over-stocked for ideal growing conditions, all of the work can be carried on in one treatment. In general, however, not over one-fourth of the wood volume should be removed at a treatment.

The following table indicates the average per acre stand that is desirable for various sizes of trees.

Group	D.B.H. in Inches	Desirable Number of Trees	Interpretation of Stand Data
A	2	75+	Under this figure indicates under-stocked due to grazing or fire. Sweetening by planting or conversion may be necessary if number of trees is less than half the desirable number.
	4	50	
	6	40	
	8	30	
B	10	20	Stocking above these figures indicates a thorough improvement cut is in order. Shortages here call for lighter improvement cuts in this size class.
	12	15	
	14	10	
	16	7	
	18	5	
C	20	3	Overages here indicate need of early harvests.
	22	2	
	24	1	
	26	1	
TOTAL		259+	

As a general rule, cultural treatment should give enough space for the development of sound, well-formed crop trees of desirable species, but at the same time cuttings should maintain a cover of sufficient density to encourage natural pruning, to control the growth of ground vegetation and to maintain forest floor conditions.

Where stocking tables are available, basal area can be used as a guide in thinning to a desirable stocking. (See chapter on Point Sampling)

### Species priority

Before marking a woodland for improvement treatment it is desirable to list all of the species in order of value.

Each woodland should be considered separately and the species priority based on stumpage value, rotation, adaptability to site, reproduction requirements and tolerance.

This priority list will serve as a guide in marking the woodland for treatment. The top species are given preference for retention in the stand, whereas an effort is made to remove the species at the bottom of the list. Den trees and other wildlife considerations must be given weight during the marking job. As marking trees to be cut is essentially a practice of the profession of forestry, it is not expected that it can be done, ordinarily, by men not technically trained. However, woodland owners can frequently assist with the marking under the supervision of the forester.

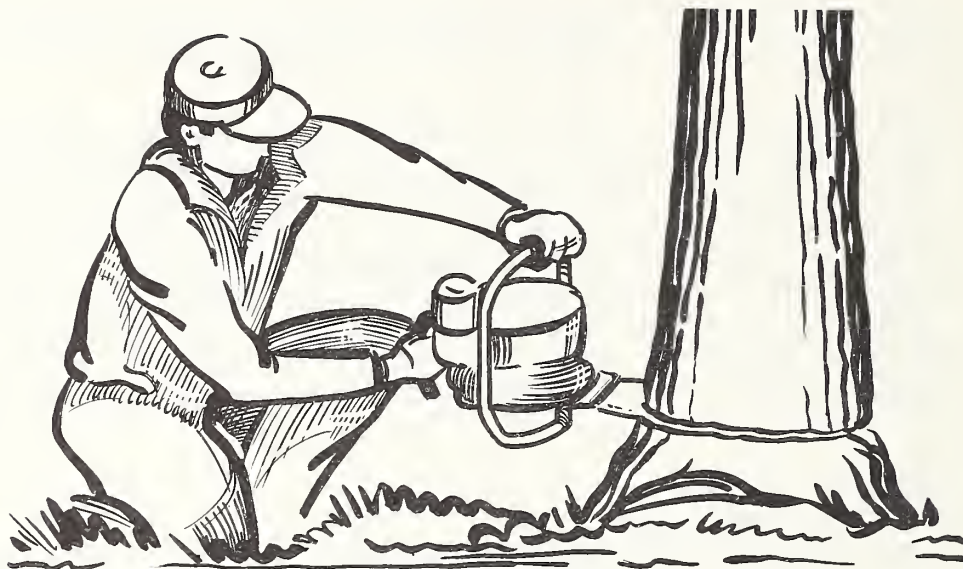
### Methods of treatment

Some woodlands will produce merchantable material from an improvement cut and in some cases a merchantable cut and improvement treatment can be combined. However, the majority of woodlands needing a cultural treatment will produce only low-value products such as fuelwood, fence posts, etc. Some improvement treatments will produce no products of value. This in no way detracts from the importance of treating the woodland, however, as many of these stands have the greatest need for treatment if they are ever to produce good quality timber.

The most popular methods of treatment are:

1. Felling with power saw, hand saw or axe.

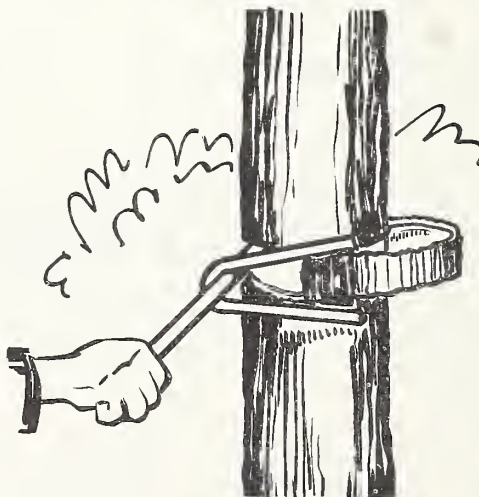
If any merchantable material is to be cut for sale or home use this method is most commonly used. The trees with no merchantable value can be either felled or deadened.



Felling with power saw

2. Girdling with axe, peeling girdler, power girdling machines or power saws.

This is the most popular method of treatment where no merchantable timber is involved. It is cheaper, faster and effective.



Girdling with peeling girdler



Girdling with  
power girdling  
machine

3. Deadening with  
basal spray.

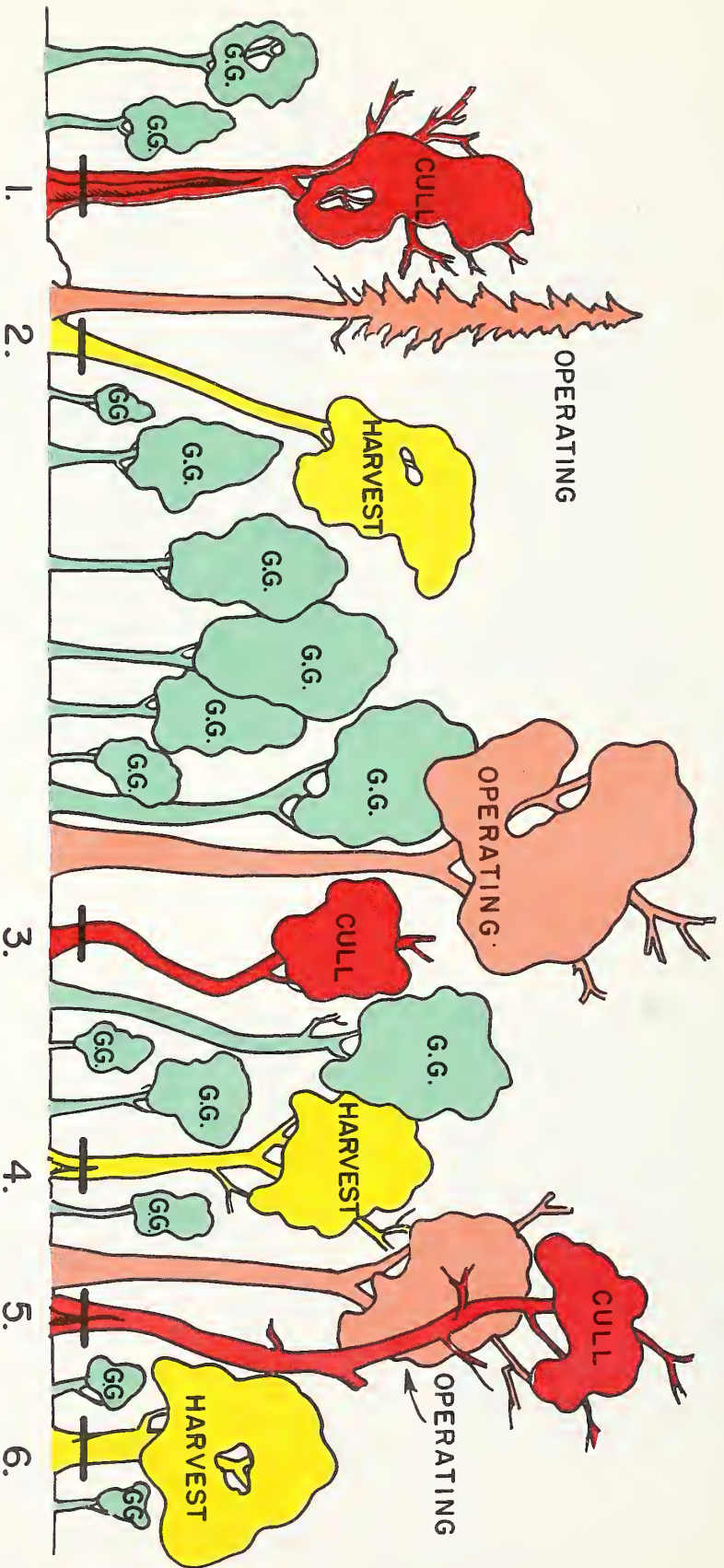
This is an effective method but is less adaptable to small woodland treatment. A mixture of 2-4-D and 2-4-5-T is produced by the Dow Chemical Company under the trade name of "Brush Killer". It is commonly used with diesel fuel as the carrier.



Deadening with basal spray

# WOODLAND IMPROVEMENT

HARDWOODS



## TREES TO BE REMOVED FROM WOODLAND BY GIRDLING OR CUTTING

1. CULL, BADLY DAMAGED BY FIRE ——— 2. ROOT SPRUNG HARVEST TREE WILL PRODUCE ONE SMALL LOG ——— 3. DEFORMED TREE, CULL ——— 4. HARVEST TREE WILL PRODUCE 1 1/2 LOGS ——— 5. DISEASED TREE, NUMEROUS FRUITING BODIES, NO MERCHANTABLE VALUE
6. WOLF TREE, OVER VALUABLE YOUNG STOCK, WILL PRODUCE 1/2 LOG.

*Legend*

GOOD GROWING STOCK	<span style="display: inline-block; width: 15px; height: 15px; background-color: #90EE90; border: 1px solid black;"></span>	HARVEST STOCK	<span style="display: inline-block; width: 15px; height: 15px; background-color: #FFFF00; border: 1px solid black;"></span>
OPERATING STOCK	<span style="display: inline-block; width: 15px; height: 15px; background-color: #FF6347; border: 1px solid black;"></span>	CULL TREES	<span style="display: inline-block; width: 15px; height: 15px; background-color: #FF0000; border: 1px solid black;"></span>

V

CARE AND MAINTENANCE OF PLANTATIONS



## V

## CARE AND MAINTENANCE OF PLANTATIONS

Plantations have been established on many farms, abandoned farm lands and old fields for the multiple purposes of growing Christmas trees, pulpwood, fence posts and sawlogs.

After the plantation is well established it must be protected against fire, cattle and the infestations of diseases and insects. Where the danger of fire is great, a fire break should be disced around the entire plantation. Discing a 10-foot fire break twice a year is recommended.

Disease and insect infestations are always a threat and the best prevention of an epidemic is close observation of the plantation and the taking of immediate control measures at the first sign of infestation.

Christmas trees

Management of plantations for Christmas tree production as intermediate or final crops usually entails special treatment in the form of shearing or pruning. This work should start about three to five years after planting and should continue each year until the trees are harvested. Special marketing practices are also involved and no trees should be cut until a market is assured.

Thinnings and improvement cuts

Plantations on the average will grow and develop so that somewhere between 15 and 40 years of age the crowns of the trees will close and competition will begin to take place. The competition is beneficial to the extent that it brings about the formation of straight, clean stems and reduces undergrowth, but if it becomes too intense it will reduce growth and kill some of the trees. Before reduced growth occurs, some of the trees should be cut out or deadened so as to provide adequate growing space for those that remain.

It is desirable, from a silvicultural standpoint, to make frequent light thinnings. However, from a practical standpoint, it is desirable to delay thinning until merchantable material, usually pulpwood or fence posts, can be removed in the operation at a profit. As a rule, with planting done under present standards, it should not be necessary to thin plantations in this region

until they produce some merchantable material. In some cases it will not be necessary to thin at all.

### Pruning

The plantation owner who wishes to grow his trees to merchantable sawtimber at the earliest age and at the same time have a maximum of clear wood may find artificial pruning a necessity.

The following guides will apply to most coniferous plantations:

1. Prune from 150 to 300 vigorous straight dominant or co-dominant trees per acre.
2. Limbs should not be removed, ordinarily, above one-half the tree height or above the point where the highest living branches interlace.
3. Trees should be pruned to one-log height (17 foot) in two or three operations. The first pruning can be done up to a height of 6 or 7 feet and following prunings each can extend another 4 or 5 feet up the stem.
4. Saws are the most satisfactory tool for pruning operations. Shears and clippers can be used on small branches but axes or machetes definitely should not be used.

Pruning



VI

SELLING FORESTRY



## VI

## SELLING FORESTRY

It is necessary to have certain basic information before attempting to sell forestry to a woodland owner. Principally, this consists of (1) a knowledge of the owner's needs and plans, (2) definite knowledge of available markets for the material which may be cut from his woodland, and (3) some measure of the volume and value of the timber on his woodland.

Selling forestry to the owner

The woodland owner is in a most advantageous position to practice good forestry. He usually lives in or near his woods and has slack seasons for part-time woods work. The forester's greatest opportunity to sell sound forestry to the woodland owner stems from these facts, but in spite of the owner's proximity to his woods, as a class, he knows less about the volumes and values of the trees growing there than either the operator or logger. He frequently has, however, a greater respect for the producing power of the soil, a deeper understanding of the importance of tree growth, and often a great personal interest in his forest land.

The following are some of the specific essentials a forester needs to know if he would sell forestry to the woodland owner:

1. The requirements of the owner (a) for an immediate cash return from his woodland; (b) for wood products for family and farm enterprise use, and (c) for additional cleared land for crops or for grazing.
2. The volume by species in the woodland classified as to cut and leave under a cutting policy which takes into account the needs of the owner, including the building up of growing stock in the area which will remain or be placed in permanent woodland.
3. Definite market opportunities for products which can be cut from the woodland now and in the future.
4. Volume and value of the growth which may be expected from the stand left in permanent woodland after the cut is made and when the woodland is protected properly from grazing and fire.

### Selling forestry to the operator

It is also necessary to have certain basic information before attempting to sell forestry to an operator. This consists of (1) a knowledge of his operating capacity and long-time plans; (2) knowledge of market requirements; (3) a measure of the volume, quality and value of the timber in his operating zone; (4) knowledge of the going cost of his operation, and (5) knowledge of the latest labor and cost-saving devices for his activity.

Some of the things a forester can do to help sell forestry to an operator are:

1. Relieve him of operations in low-quality timber. How?  
By encouraging farm owner operations. Why? Because farmers can operate at lower cost.
2. Sponsor meetings and demonstrations by related agencies. What for?
  - a. To enlarge the staff of salesmen.

Meetings and demonstrations on:

- a. Labor and cost-saving devices.
  - b. Improved handling.
  - c. Improved organization.
  - d. Improved yarding and stacking.
  - e. Improved grading.
  - f. Improved marketing.
  - g. Improved mill and equipment maintenance.
  - h. Improved safety practices.
3. Maintain and display operating circle showcases developed around individual sites.  
  
Show what?
    - a. Volume for immediate cut. (Harvest stock.)
    - b. Volume for specified periodic cuts. (Operating stock.)
    - c. Annual growth; specified periodic cuts. (Good growing stock.)
    - d. Year specific tract was analyzed. (For ready calculation.)
  4. Correlate his capacity and long-term plans with #3 above.
  5. Develop an operating circle plan for individual operators based on the above information (#1 through #4).

Possible results of the forester's efforts:

Raising the percentage of higher-grade lumber, thereby increasing the average selling price. High average selling cost, minus lower logging and milling cost equals greater margin of profit. This is the key to selling forestry to operators.

### The Agricultural Conservation Program

Much needed timber stand improvement can be done by working through the A.C.P. program.

It is not the A.C.P. program; in fact, it is really the forester's program. He recommends the practices, plans the work and approves the completed job for payment. A.C.P. cost-sharing payments should be recognized as an aid in encouraging the management program of the service foresters.

Each service forester should make every effort to further the work done under A.C.P. by taking the following steps in each county:

1. Be on hand for fall planning meeting of A.S.C. Committee. Push for approval of the T.S.I. practice.
2. Promote the program with farmers by meeting with community committeemen. Sell them on the value of the practice.
3. Get the names of farmers who have signed up for the T.S.I. practice, number of acres and period from A.S.C. offices.
4. Set up a work schedule to visit each woodland to select the most suitable area to be worked.
5. Give owner training in doing the stand improvement work. Mark sample area, or entire area, as the case dictates.
6. Return when job is completed and go over area with owner.
7. Fill out approval form when job is satisfactory and turn over to A.S.C. office.

### Appraising the woodland

Gathering information to show a woodland owner that it is more worthwhile to manage his woodland than to neglect it ordinarily

requires an estimate and appraisal of the growing stock present on the woodland. Ability to show him the comparative value of his growing forest, cultivated fields and pasture lands, and to compare the woodland value as an investment with bonds or other investments, may help convince him he has something worth care and development.

This type of material may be quickly worked up in the form on the back of the log scale cumulative volume tally sheets, Forms 2102, 2103, and 2104 R-9.\* The form provides space for calculating the following information.

1. Present net volume and value of the stand which will be cut and that which will be left to grow.
2. Volume and value of fuelwood in cull trees and tops of trees.
3. Growth per acre per year in volume that the remaining stand may be expected to produce.
4. The permissible annual cut which may be harvested each year or lumped for harvest every few years.
5. The investment value of the land for producing timber. This is the theoretical sale value of the tract in question and is generally calculated for comparison with the current sale value of adjacent similar lands or areas growing other farm crops.
6. The value of the growing woodland as an investment, financial reserve, or emergency fund.

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\* For the method of using the Cumulative Volume Tally Sheet see Appendix, Page 7. These printed forms are available from H. Niedecken Company, Milwaukee, Wis.

## I. VOLUME AND VALUE SUMMARY

\_\_\_\_\_ ACRES

SPECIES →								ALL
VOLUME — MBM	TOTAL							
	GOOD GROWING							
	STORAGE							
	HARVEST							
PRICE PER MBM	GOOD GROWING	\$	\$	\$	\$	\$	\$	\$ [B]
	STORAGE & HARVEST	\$	\$	\$	\$	\$	\$	\$
VALUE	GOOD GROWING	\$	\$	\$	\$	\$	\$	\$
	STORAGE	\$	\$	\$	\$	\$	\$	\$
	HARVEST	\$	\$	\$	\$	\$	\$	\$

## II. FUELWOOD IN CULL TREES

## APPROXIMATE FUEL VOLUME IN CULL TREES

Average DBH	Standard Cords
12"	.16
14" - 16"	.3
18" - 20"	.5
22" up	1.0

Total number of cull trees \_\_\_\_\_ X [E] \_\_\_\_\_ = \_\_\_\_\_ Total cords cull fuelwood  
 at \$ \_\_\_\_\_ per cord = \$ \_\_\_\_\_ Total value cull fuelwood

## III. GROWTH ON GOOD GROWING STOCK

HEIGHT FACTORS	
H	F
16'	1.20
24'	1.07
32'	1.00
40'	.95

- Average tree (DBH 12" up) — DBH \_\_\_\_\_ inches [D]; USED HEIGHT \_\_\_\_\_ feet [H] → GROWTH RATE IN RINGS PER INCH \_\_\_\_\_ [R]
- GROWTH per year in average tree [D] X [H] X [F] = \_\_\_\_\_ Board Feet [G]  
 $10 \times [R]$
- INGROWTH per year from NEAR MERCHANTABLE trees (DBH 10") into MERCHANTABLE stand (DBH 12" up)  
 Number of trees per acre 10" DBH \_\_\_\_\_ X  $\frac{50}{[R]}$  board feet = \_\_\_\_\_ board feet [K]
- TOTAL GROWTH per year:  
 Number of trees per acre (DBH 12" up) \_\_\_\_\_ X [G] = \_\_\_\_\_ plus [K] = \_\_\_\_\_ board feet PER ACRE [L]
- Years required (Cut) \_\_\_\_\_ = \_\_\_\_\_ YEARS [L] X \_\_\_\_\_ = \_\_\_\_\_ board feet TOTAL in Farm Forest [M]  
 for growth to replace cut. [M] acres

## IV. PERMISSIBLE ANNUAL CUT

Permissible ANNUAL CUT: [L] X .8 = \_\_\_\_\_ board feet PER ACRE [N] X \_\_\_\_\_ = \_\_\_\_\_ board feet TOTAL on Farm Forest  
 FUELWOOD in [N] X 1\* = \_\_\_\_\_ cords PER ACRE X \_\_\_\_\_ = \_\_\_\_\_ cords TOTAL on Farm Forest  
 tops in annual cut: 1000 acres

## V. VALUES IN THE GROWING FARM FOREST

1. [B] stumpage @ \$ \_\_\_\_\_ per M [S] = [S] X [S] = [S] TOTAL VALUE of yearly growth  
 [L] Growth/acre per year logs @ \$ \_\_\_\_\_ per M = [S] X [S] = [S]  
 products @ \$ \_\_\_\_\_ per M = [S] X [S] = [S]

2. INVESTMENT VALUE  
 of gross income from Farm Forest Land = [S]\*\* [P]

Timber sold as	VALUE OF FOREST LAND at Farmer investment money rate .0 _____ [P]	
	PER ACRE	TOTAL _____ acres
STUMPAGE	\$	\$
LOGS	\$	\$
PRODUCTS	\$	\$

\* Approximately 1 standard cord per MBM fuelwood in tops and cull logs.

\*\* If investment value of net income is desired, deduct taxes and other charges from [S]

### Method of using the reverse side of Forms 2102, 2103 and 2104, R-9

This form represents a flexible scheme, rather than a prescribed method. It is a suggested method of carrying through calculations to show the approximate financial results from any type of cutting practice. Factors printed in on the sheet may be changed if better or more applicable figures are on hand. Primarily the sheet is designed to give the forester a simple systematic method of analyzing the economic results and value of the investment in residual timber resulting from any type of cutting practice. This analysis can be made in 20-30 minutes following completion of the woodland inventory. With the results the forester is in a position to determine for himself the economic results of any type of cutting. With these results in mind, he can talk to the owner in economic terms most appropriate to sell him on the best type of practice for his situation.

### Volume and value summary

The block at the top of the sheet is for summarizing the net volume from a cut and leave tally, for calculating total values based on current local prices and estimating fuelwood in tops and cull logs of trees in merchantable stand. This summary may be made for the average acre or for the total area.

### Fuelwood in cull trees

Total number of cull trees is multiplied by the fuelwood volume for the average size cull tree to get total cords of cull fuelwood. The average diameter of cull trees may be judged in the field or may be computed if tally has been made by diameter classes. Application of the net return value per cord to the volume of fuelwood will give the total fuelwood value in cull trees.

### Growth in remaining stand

1. The average tree in the remaining stand is determined by inspection of calculation and its d.b.h.; used height and rate of growth are listed in the blanks provided.
2. Taking factor F for the used height of the average tree, from the table of height factors, the formula listed under 2 is worked out. The diameter in inches times the used height in feet, times this factor, divided by 10 times the number of rings per inch growth rate, gives the approximate number of board feet net growth lumber tally of the average tree per year.

3. For average timber, the in-growth per acre per year of near merchantable (10") trees into the merchantable stand (12" and up), is calculated by multiplying the total number of trees per acre in this size class by  $\frac{50}{R}$  where R is the growth rate in rings per inch of the near merchantable trees. (For short timber  $\frac{40}{R}$  and for tall timber  $\frac{60}{R}$  may be used instead of  $\frac{50}{R}$ .) The rate of growth of these small trees may be found to be more rapid than that of the average tree in the remaining stand.

This calculation gives the board feet of growth added to the stand per acre per year due to near-merchantable trees becoming merchantable. Because these trees were formerly assigned no volume, the volume added per tree may be larger than the increment shown for some of the merchantable trees.

4. The total growth per acre per year is calculated by multiplying the number of trees per acre in the stand left by the growth of the average tree in the stand left, and adding to it the in-growth per acre calculated in 3.
5. The years required for growth to replace the stand cut is determined by dividing the volume of the stand cut by the growth per year, both figures being per acre or total. This figure will help the farm forester judge whether or not his estimated first cut is too heavy or too light.

#### Permissible annual cut

To allow a safety factor for building up the stand, which ordinarily is understocked, a permissible annual cut is calculated at 80% of the net annual growth in the stand left. This factor may be varied according to the judgment of the man on the ground.

In calculating future harvests, the in-growth should be withheld for the period of time required for the 10" trees to reach the minimum diameter desired for cutting.

#### Woodland grazing

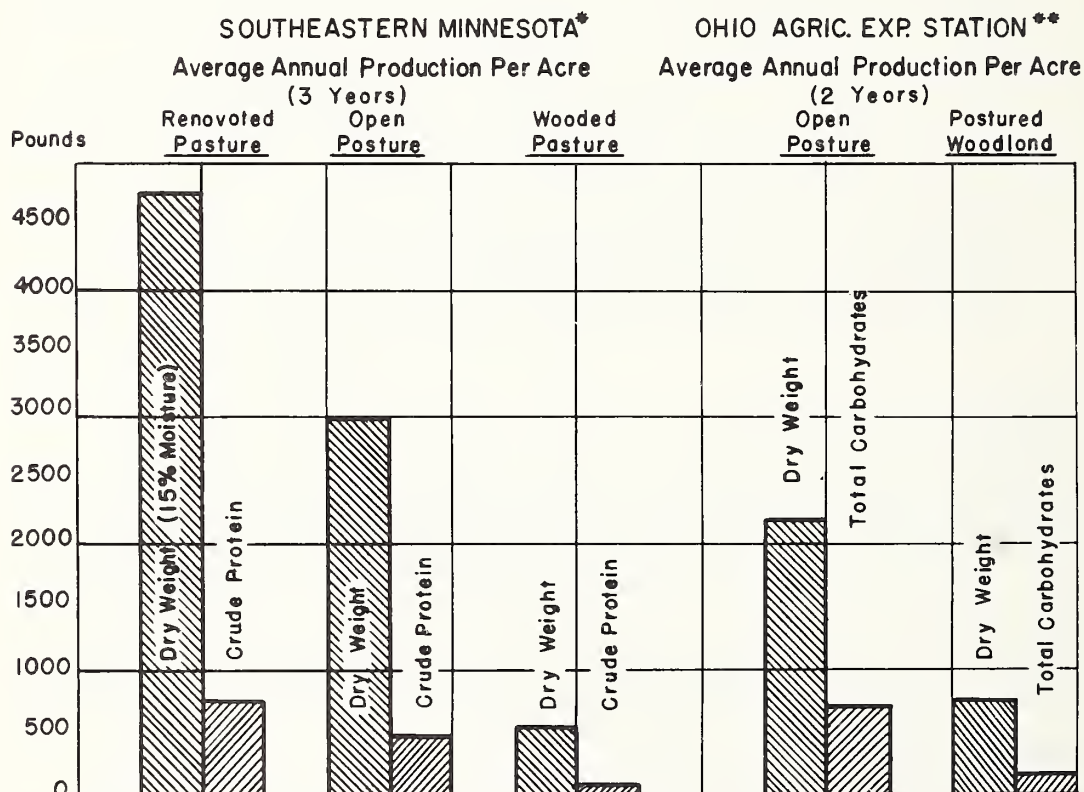
Service foresters are constantly confronted by the harmful effects of intensive grazing in woodlands. The job in this case is one of selling an idea. Facts and figures are required to convince the landowner that he should not turn livestock into his woodland.

Some of the facts listed here may be helpful in selling the land-owner on this highly important phase of the program:

1. The forage grown in woodland is poorer than that produced in open pasture.

#### Experiment A.

Studies on dry weight and crude protein production showed these results:



\* 180-day tests by Univ. of Minnesota and Soil Conservation Service

Basis: 12 plots on each of four forms

\*\* Journal, American Society of Agronomy, 18: 226, 238, 1926

## Experiment B.

Yields of dry matter in pounds per acre (a) from woodland pastures, and (b) renovated and untreated open pastures in the 15-25% and 26-35% slope classes in Richland County, Wisconsin during the period 1941-1945 inclusive.\*

Kind of pasture	5-yr. average		Average
	15-25%	Slope classes 26-35%	
Woodland	292	259	276 **
Open (untreated)	1776	1131	1453
Open (renovated)	3367	3054	3210 **

Grazing capacity.

Grazing capacity is a variable figure throughout the region, but various studies\*\*\* indicate these approximate carrying capacities:

<u>Kind of Pasture</u>	<u>Acres Per Cow</u>
Dense woodland	9 plus
Average woodland	4.5 to 9.0
Open woods pasture	3.0 to 4.5
Steep open pasture	2.3 to 3.6
Bluegrass on rolling land	1.4 to 2.3
Bottom land pasture	1.1 to 1.4
Improved or legume pasture	.75 to 1.4

\* Reported in Journal of Forestry, October, 1946 - Ahlgren, Wall Muckerhirm and Sund.

\*\* An analysis of the forage produced from the open renovated pasture, showed that the protein yield was twice as much per pound as that of the woodland pasture.

\*\*\* "Pasture Production and Utilization in Southwestern Wisconsin," SCS and Wis. Agr. Exp. Sta. cooperating, May, 1932. Also computed from SCS Agronomists' estimate using 180 pasture days as basis.

2. Grazing is detrimental to maple syrup production.

Studies made by Dambach\* over a 5-year period give the following results, average annual production of syrup per acre:

Grazed tract - - - - -	16.2 gallons
Ungrazed tract - - - - -	21.9 gallons

3. Some weeds and trees commonly found in woodlands are poisonous to cattle.

Examples:

Poisonous Plants and Trees\*\*

Common brake	Water hemlock
White oak	Whorled milkweed
Pokeberry	White snakeroot
Dwarf larkspur	Kentucky coffeetree
Dutchman's breeches	Ohio buckeye
Black cherry	

4. The packed condition of the soil resulting from grazing discourages absorption of rainfall and also allows greater runoff causing erosion on the steeper slopes.

Example: Comparative runoff of precipitation in 50-gal. barrels per acre. Average for 4-year period is for areas in the same locality with same topography and exposure.

Open, moderately-grazed pasture	Grazed woodland	Ungrazed and unburn- ed woodland
92.2	295.5	6.2

5. In most states, cost-sharing is allowed for constructing fences where needed to protect farm woodland from grazing under the Agricultural Conservation Program.

These five points involved substantiate the contention that pastured woodland is neither good pasture nor good woodland. If additional pasture is required, a farmer can increase the capacity of his existing unimproved pasture by improvement measures.

---

\* "Comparative Productiveness of Adjacent Grazed Land Ungrazed Sugar Maple Woods." Charles A. Dambach, Journal of Forestry, 1944.

\*\* "Plant Poisoning of Animals," Graham and Pieper, U. of Ill. 1936, and U.S.D.A. Leaflet #86.

If, after improving the existing pasture, more pasture is still needed, it might be worthwhile to clear that portion of the woodland most suited for additional open pasture. The selected portion of the woodland should be completely cleared and improved. The remaining woods should be fenced and stock kept entirely out. (From Lake States Forest Experiment Station Technical Note No. 142.)



VII

MARKING TIMBER



## VII

## MARKING TIMBER

Timber marking and an accumulative record of volumes to be cut are guides designed to keep the volume to be logged within the growth capacity of the forest. Tree marking is the most effective way to assure good forest management. Light, selective cuts are repeated at short intervals to remove high risk trees. Low-value species should be marked if a local market is available. Good timber marking is a bulwark against over-cutting and high grading. Hasty shortcuts introduce errors, particularly errors of omission. Extreme haste tends to reduce the farm woodland owner's faith in the work of the forester. Diameter limit cutting is a most common and undesirable shortcut.

Some of the principal factors a forester must keep in mind when marking timber are:

Maintenance of a strong stand of commercial growing stock.

Tolerance of trees.

Thrift and vigor.

Defect and rot.

Species.

Site quality.

Spacing of trees.

Stocking of stand.

Quality of products obtainable.

### Marking guide

The data collected in the analysis of the woodland, coupled with the information given by the owner as to his plans and circumstances, will enable the forester to determine what, if any, volume should be removed from the woodland. (It should be remembered that the volume to be cut is not sold on the basis of the cruise data, but is sold on the basis of the volume shown by the marking tally, which is a 100% measurement of the trees to be harvested.) By referring to the summary sheets for the harvest and operating stock, the forester can see what the woodland has available to meet the situation. If the volume in harvest stock is insufficient to meet the needs, he can dip into the operating stock for all or as much as is needed. If only a part of the operating stock is needed, he can select the high-risk, low-value trees in this class. It is a good policy to reserve at least a portion of the operating stock as on-the-stump material to supply the owner's needs for home-use material.

If both the harvest stock and operating stock do not provide enough volume to meet the owner's needs, and if his needs are important enough to justify reducing the growing capacity of his woodland for the next 50 years, additional volume for harvesting can only be obtained from the good growing stock. This additional volume should be selected from the least desirable species which appear on the good growing stock tally. If such species do not provide the necessary volume, then the balance between the number of trees in diameter classes should be examined on the tally sheet and the additional volume marked from diameter classes which the tally indicates have a surplus number of trees. If none of the diameter classes has a surplus of trees, the additional volume needed will have to be selected from the largest diameters.

There is much flexibility in the use of the data collected by tree classes for use in guiding the marking. The accuracy of the cruise figures, of course, is much less for the volume by species than for the entire stand, but generally the marking tally will coincide with the predetermined volume obtained from your marking rules.

When the forester prepares a marking guide from these cruise figures he has a definite picture in his mind of the trees which should be marked. The harvest trees are already singled out for him as definitely as if they were already marked. If he knows the volume in the harvest trees is more than he needs to meet the needs of the case, he can gauge his marking to take out only the trees of the harvest class which indicate they will lose volume most rapidly through decay.

When the forester marks a tree for cutting he should look for the logical place to fell it. If there is no place, then he should mark a tree or trees to make an opening. This prevents "hang-ups" and damage to the most valuable growing stock.

### Tree grading

A systematic way of selecting trees by their silvicultural and economic qualities is the inevitable outgrowth of any individual tree marking process. Such systems for tree grading are available. Briefly, they define the health or growing qualities of trees, the risk of losing them over the years, and the quality of products obtainable from them.

Tree grading is thus a grade labeling process for trees. As such, it helps the forester to decide the relative value of trees as growing stock and as cutting stock. Systematic tree classification is the forester's best guide to tree marking and good forest practices.



VIII

LOGGING



## VIII

## LOGGING

The forester should understand the underlying principles of getting logs out of the woods. Some guides to the logging job are given in this section. Before considering them it may be wise to review the essential steps to be used in setting up a logging plan for a woodland owner whose objective is to maintain and build up his woods.

Steps in the logging job

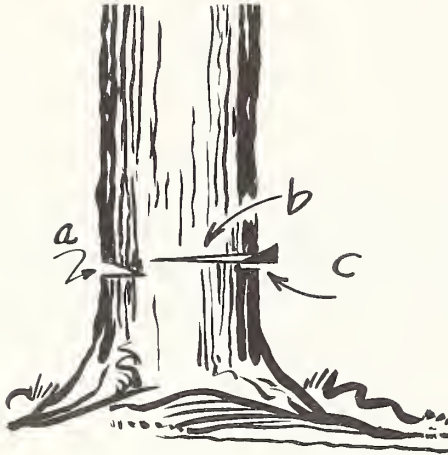
1. Map the area roughly, showing the topography and extreme variations in stand density.
2. Lay out a permanent road system designed for frequently repeated selective cuts. Include log landings, buzz saw set-ups, main skidding trails and turn-arounds. Existing road system to be corrected where necessary. Avoid locations which will result in excessive run-off and erosion.
3. Relate the entire road system to a portable mill set-up within or just outside of the woodland.
4. Make plans to insure that the trees will be cut up into the highest grade logs possible and yet fully utilize the commercial length of the tree. This means that the log lengths should be measured out for the whole tree in advance of sawing out the logs to obtain maximum quality.

Safe harvesting methods

Logging operations present many serious safety hazards. It is not the intention to give a detailed discussion of all types of woodland harvesting methods but rather to point out some of the most dangerous operations and the safety precautions that should be followed.

a. Felling.

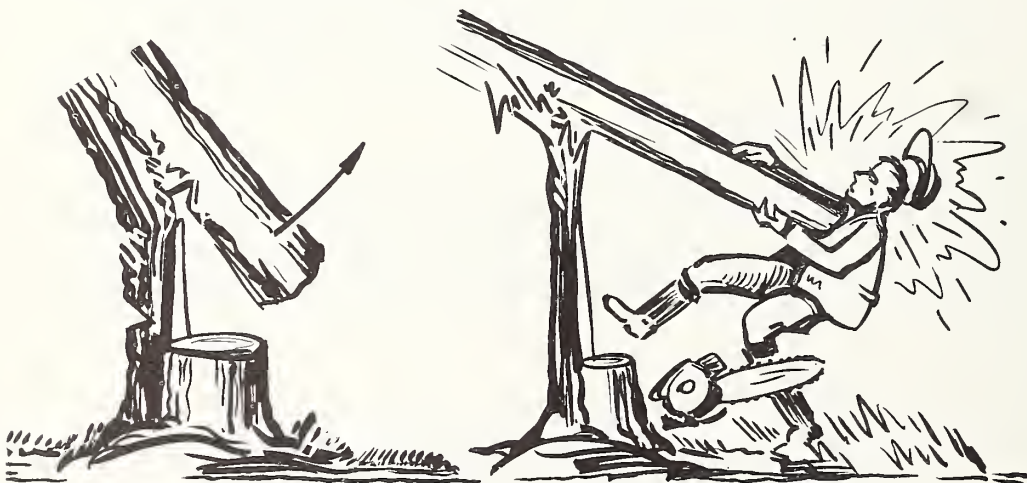
In the felling of trees, the most important point to watch is the undercut. It should be made as illustrated on the following page. Its depth should represent at least one-fourth of the diameter of the tree. Make felling cuts slightly above the undercut.



Most satisfactory method of felling a straight tree.

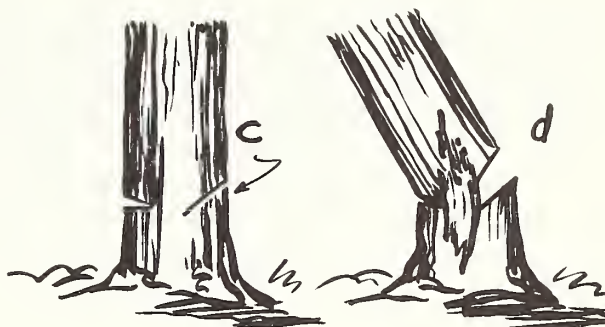
- a. Undercut
- b. Saw cut
- c. Felling wedge

When the felling cut is made too low, a split usually results and this presents the possibility of a dangerous kick-back.



Improper undercuts cause kick-backs which are dangerous

The most valuable part of the tree is in the butt log and it pays to save all of it. A slanting cut shown in "c" results in the bridge being pulled out in the form of log whiskers.



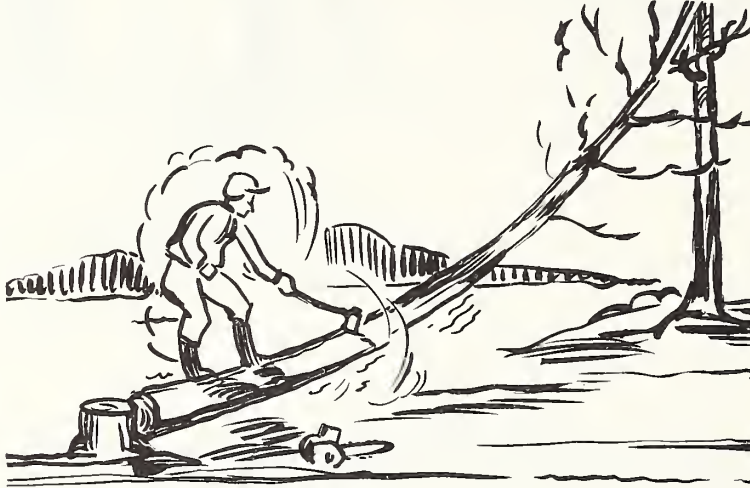
A slanting cut  
causes the bridge to pull out

It is important to keep away from the base of the tree, especially on sloping ground, when it begins to fall.



Stay away from the base of trees when  
they fall, especially on sloping ground

When a tree lodges, a faulty undercut usually is the reason, but the important point is that it must be taken care of before it dislodges and falls on a workman. The safest way is to pull it down with a chain and horse or tractor, or fell another tree across it. Do not try to shake it loose as shown below.



It is dangerous to shake a lodged tree down

The most dangerous tool the farmer must use in the woods is the ordinary axe, and if it is not sharp, the hazard is multiplied several times. Keep an axe sharp; a dull axe or one that has too thick a blade may glance off and injure the cutter or a fellow woodsman.



A sharp axe cuts into the wood as shown in "a".

A dull axe may glance off and injure the workman as shown in "b".

b. Trimming.

It is important that the cutter stand on the opposite side of the tree from which he is cutting the limbs, as shown at right below. If it becomes necessary to trim up short lengths after they have been bucked, the axe should be grasped close to the head and short strokes used; never grasp the axe close to the end of the handle when trimming short lengths.



It is dangerous to stand on the same side you are limbing  
or to use one hand

The safe way  
to branch a tree

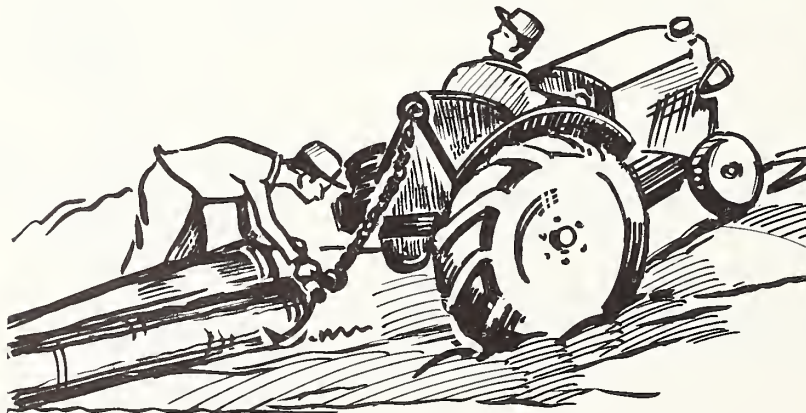




If you must limb short lengths,  
grasp the axe handle near the head

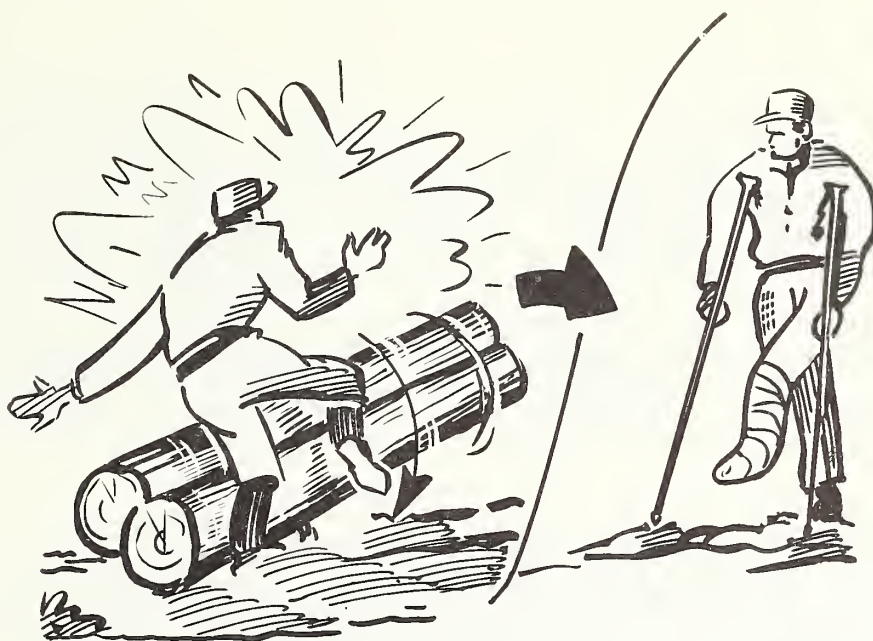
#### c. Skidding.

Skidding logs is dangerous and this is especially true  
at the time the skidding chain is being fastened.



Face the tractor when hooking skid chain

Walk back of the load if possible; if not, watch for obstructions  
and change sides to avoid being side-swiped.



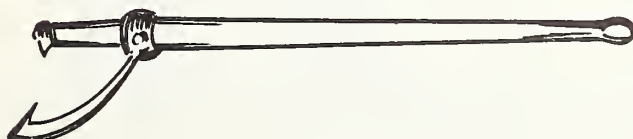
Do not walk on the downhill side of the load



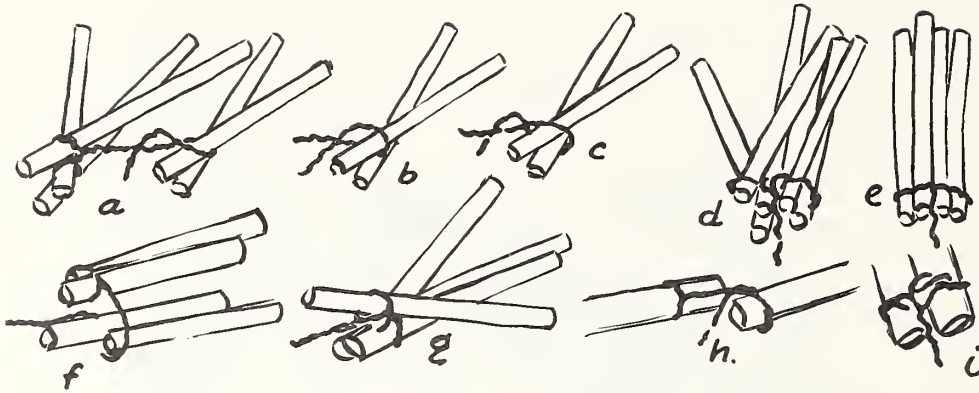
When a workman finds it necessary to lift logs, it is important not to risk a sprained back but rather do it in the safest way which also is the easiest.

a. The wrong way to lift heavy loads.

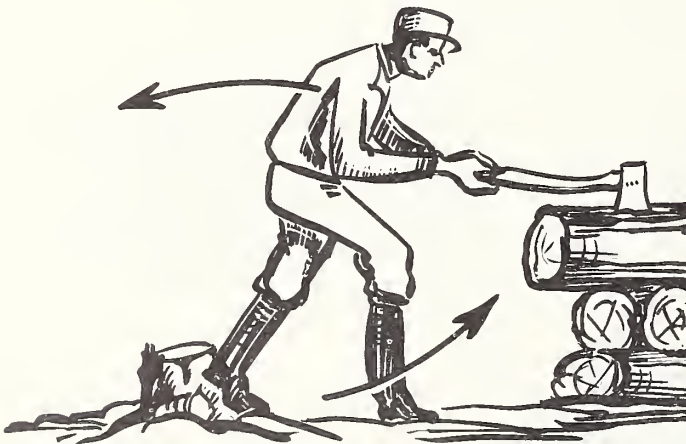
b. The correct way.



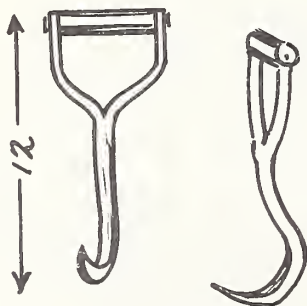
It would be better to use a cant hook and roll heavy logs or use a log jack.



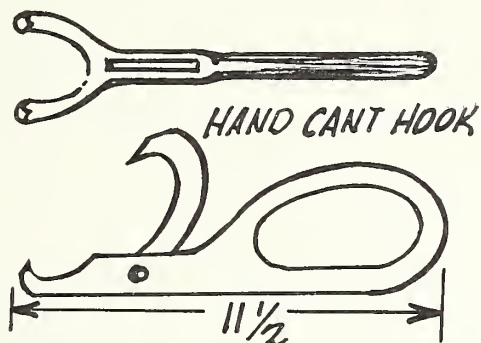
Several scattered logs may be bunched as shown in "a", "b", and "c" above. The same load after being tightened by hand, "d", and after it has started to move "e". Bad hooking does not pay, "f", hooked too loose, won't hold; "g" too uneven. Sometimes logs can be hooked without swinging as in "h" and "i".



When cutting and piling short lengths of logs (usually of cordwood size), there is always a temptation to use the axe as a handling tool. Use a pulp hook instead, but even this must be handled properly to eliminate the possibility of injury.



A pulp hook eliminates much lifting and carrying when handling cordwood or posts. However, it must be used with care.



A hand-type cant hook is the safest way to handle pulp sticks or posts.

d. Carrying tools.

Carry an axe by grasping the handle near the head; never over the shoulder. When a power saw is carried in the woods the motor should be turned off. Men unaccustomed to working in the woods are not as sure-footed as full-time lumberjacks. For this reason it pays to give more than normal attention to one's footing and the path which he is following.



Wrong



Right

The wrong way of carrying tools is shown in picture on left. If this man stumbles, he may injure himself with the axe. Carry tools as shown in picture on right.



IX

SAWMILLING



## IX

## SAWMILLING

Sawmill analysis and adjustment

Familiarity with sawmill machinery and an understanding of its use, possibilities and limitations is necessary before anyone undertakes to analyze an operation and recommend changes. While desirable, it is not necessary that the analyst have experience operating or working in a mill. It is, however, important that he readily understand all parts of a mill, the function of each part, and the best manner of its coordinated use. This understanding can be obtained by study of the following references:

1. Small Sawmill Operator's Manual. Agriculture Handbook No. 27.
2. Instructions on Analyzing Portable Sawmills - Forest Products Laboratory.
3. Industry pamphlets, such as:
  - Better and More Economical Sawing. (Henry Disston & Sons, Inc., Philadelphia, Pa.)
  - Useful Facts - Sawmills and Saws. (Frick Company, Waynesboro, Pa.)
  - Facts for Mill Men. (Simonds Saw & Steel Company, Fitchburg, Mass.)
4. Miscellaneous publications.
  - Maintenance of Inserted Tooth Circular Saws. (U.S.F.S.)
  - Give your Head-Saw a Chance. (U.S.F.S.)
  - More Lumber with Less Labor. (U.S.F.S.)
  - Small Sawmills - A Pocket Guide. U.S.F.S. Agr. Handbook No. 70.

Foresters will find the following lists to be convenient aids for checking sawmill operations and maintenance or repair items requiring attention. It is not intended that the Service Forester use these check lists to inspect sawmills himself. Copies of these check lists, however, can be provided to sawmill operators to aid them in checking their equipment.

Name Owner \_\_\_\_\_  
 Name Mill \_\_\_\_\_  
 Type Mill \_\_\_\_\_  
 Location \_\_\_\_\_  
 Analyzed by \_\_\_\_\_  
 Date \_\_\_\_\_

### SAWMILL MECHANICAL ANALYSIS

#### I. SAW

1. Diameter \_\_\_\_\_
2. Number of teeth and manufacturer's  
name and number \_\_\_\_\_
3. Gullet space \_\_\_\_\_
4. Style and gauge \_\_\_\_\_
5. R.P.M. \_\_\_\_\_
6. Maximum possible feed per 1 re-  
volution of saw \_\_\_\_\_
7. Present feed 6" cut \_\_\_\_\_  
                               8" cut \_\_\_\_\_  
                               10" cut \_\_\_\_\_  
                               12" cut \_\_\_\_\_
8. Diameter of Mandrel Pulley \_\_\_\_\_

#### II. DERIVED INFORMATION

1. Teeth per inch of feed 6" cut \_\_\_\_\_  
   8" cut \_\_\_\_\_  
   10" cut \_\_\_\_\_  
   12" cut \_\_\_\_\_
2. Present carriage speed in feet  
per minute 6" cut \_\_\_\_\_  
   8" cut \_\_\_\_\_  
   10" cut \_\_\_\_\_  
   12" cut \_\_\_\_\_
3. Maximum carriage speed in feet  
per minute \_\_\_\_\_
4. Gullet space holding capacity \_\_\_\_\_

#### III. RECOMMENDED CHANGES

1. Feed ratio change \_\_\_\_\_
2. Teeth Gullet \_\_\_\_\_
3. Percent reduction of saw speed \_\_\_\_\_
4. Pulley ratio \_\_\_\_\_

(See Instructions on following page)

### INSTRUCTIONS

- I.
  1. Measure across saw from tooth tip to tooth tip.
  2. Count all teeth.
  3. Trace outline of gullet space on cross section paper and count squares.
  4. Either solid or inserted tooth saw.
  5. Obtain with tachometer and watch.
  6. Power unit shut down. Engage the feed lever, move saw until all slack in cable taken up, then measure the advance of the carriage per 1 revolution of saw. Measure total distance moved during 4 or 5 revolutions and obtain average.
  7. Examine boards and timbers as they come from saw, measure the feed marks for cuts of different size from 6" to 12" or greater. Boards should be square edge not outside wane edge boards. Measure in center of board.
  8. Measure diameter of driven pulley on mandrel.
  
- II.
  1. For each size cut, divide number of teeth in saw by present carriage feed for that size cut: Example - 40 tooth saw - present carriage feed 8" cut is 4 inches.  
 $40 \div 4 = 10$  teeth per inch of feed.
  2. Saw speed in revolutions per minute. Inches of carriage feed per revolution of saw. Formula:  $\text{RPM (saw)} \times \text{present feed (carriage)} \div 12$  equals speed in feet per minute. Example:  $(\text{RPM}) 400 \times 4" (\text{feed}) \div 12 = 133$  feet per minute.
  3.  $\text{RPM (saw)} \times \text{present maximum feed (carriage)} \div 12 =$  maximum carriage speed per minute.
  4.  $1/2$  the measured space in I-3.
  
- III. Recommendations will be based on results of analysis and in discussion with mill operator.

# SAWMILL MAINTENANCE ANALYSIS

I. FOUNDATION: Solid \_\_\_\_\_ Posts or mud sills large enough \_\_\_\_\_

II. HUSK: Level \_\_\_\_\_ Well braced \_\_\_\_\_ Bolted in place \_\_\_\_\_

A. MANDREL: Level \_\_\_\_\_ Straight \_\_\_\_\_ Sufficient bearing \_\_\_\_\_  
 support \_\_\_\_\_ Excess end play \_\_\_\_\_ Diameter of pulley \_\_\_\_\_  
 Diameter of mandrel \_\_\_\_\_

B. BEARINGS: Type \_\_\_\_\_ Well bolted \_\_\_\_\_ Tight on  
 mandrel \_\_\_\_\_ Running cool \_\_\_\_\_

C. SPREADER WHEEL: Well bolted \_\_\_\_\_ Proper position \_\_\_\_\_  
 Proper size \_\_\_\_\_ Proper alignment \_\_\_\_\_

D. PULLEY: Proper alignment \_\_\_\_\_ Tight on mandrel \_\_\_\_\_  
 Type \_\_\_\_\_

E. GUIDES: Well bolted \_\_\_\_\_ Proper position \_\_\_\_\_  
 Proper pin clearance \_\_\_\_\_ Type \_\_\_\_\_

III. TRACK: Proper alignment \_\_\_\_\_ Level \_\_\_\_\_ Securely  
 fastened \_\_\_\_\_ Type of rail \_\_\_\_\_

A. SHEAVE WHEEL & BRACKET: Securely bolted \_\_\_\_\_ Center  
 pin worn \_\_\_\_\_

B. FEED DRUM: Tight on shaft \_\_\_\_\_

C. RING GEAR & PINION: Good condition \_\_\_\_\_ Proper  
 mesh \_\_\_\_\_ Bearings in good condition \_\_\_\_\_

IV. CARRIAGE: Level \_\_\_\_\_ Excess end play \_\_\_\_\_ Type \_\_\_\_\_

A. HEADBLOCK: Correct alignment \_\_\_\_\_ Knees and base  
 square \_\_\_\_\_ Bases level \_\_\_\_\_ Sufficient  
 number \_\_\_\_\_

B. SET SHAFT & PINION: Tight \_\_\_\_\_

C. PAWL DOGS: Good condition \_\_\_\_\_ Slack \_\_\_\_\_

D. TAPER OR OFFSET KNEES: Tight on headblock \_\_\_\_\_ Sufficient  
 number \_\_\_\_\_

E. DOGS: Tight on headblock \_\_\_\_\_ Points sharp \_\_\_\_\_

F. CABLE: Tight \_\_\_\_\_ Good condition \_\_\_\_\_

G. SET WORKS: Type \_\_\_\_\_ Type of receder \_\_\_\_\_

H. CLEARANCE OF BUNKS: from saw \_\_\_\_\_; above collar \_\_\_\_\_

V. SAW: Plumb \_\_\_\_\_ Proper lead \_\_\_\_\_ Properly filed \_\_\_\_\_  
 Properly swaged \_\_\_\_\_ Rings or holders tight \_\_\_\_\_ Teeth  
 in place \_\_\_\_\_ Operated at proper speed \_\_\_\_\_ Holders  
 in good condition \_\_\_\_\_ Collar proper size \_\_\_\_\_  
 Right hand or left hand \_\_\_\_\_ Properly mounted on lug  
 bolts \_\_\_\_\_

VI. POWER: Solid foundation \_\_\_\_\_ Well braced \_\_\_\_\_  
 Sufficient \_\_\_\_\_

- VII. EDGER: Solid foundation \_\_\_\_\_ Well braced \_\_\_\_\_  
 Level \_\_\_\_\_ Proper location \_\_\_\_\_ Feed \_\_\_\_\_  
 rolls parallel to saw mandrel \_\_\_\_\_ Excess \_\_\_\_\_  
 end play in saw mandrel \_\_\_\_\_ Saws filed \_\_\_\_\_  
 properly \_\_\_\_\_ Excess play in loose \_\_\_\_\_  
 saw \_\_\_\_\_ Operated at correct speed \_\_\_\_\_  
 Saws guarded \_\_\_\_\_
- VIII. SWING CUT-OFF SAW: Correct location \_\_\_\_\_ Solid  
 foundation \_\_\_\_\_ Properly braced \_\_\_\_\_  
 Bearings well bolted \_\_\_\_\_ Bearings tight \_\_\_\_\_  
 on mandrel and shaft \_\_\_\_\_ Excess play on saw \_\_\_\_\_  
 mandrel \_\_\_\_\_ Saw filed properly \_\_\_\_\_  
 Saw set properly \_\_\_\_\_ Saw guard in \_\_\_\_\_  
 place \_\_\_\_\_ Weights and cable sufficient for \_\_\_\_\_  
 swing back clearance \_\_\_\_\_ Correct speed \_\_\_\_\_
- IX. SAW DUST DRAG: Proper position \_\_\_\_\_ Proper  
 speed \_\_\_\_\_ Proper length of chain \_\_\_\_\_  
 Guards in place \_\_\_\_\_
- X. SAW DUST BLOWER: Proper position \_\_\_\_\_ Solid  
 foundation \_\_\_\_\_ Securely fastened \_\_\_\_\_  
 Proper size \_\_\_\_\_ Screen in place \_\_\_\_\_
- XI. LUMBER ROLLS: Properly spaced \_\_\_\_\_ Correct  
 height \_\_\_\_\_ Sufficient length \_\_\_\_\_  
 Turn freely \_\_\_\_\_
- XII. MILL LOCATION AND LAYOUT: Sufficient space \_\_\_\_\_  
 Proper drainage \_\_\_\_\_ Accessible to timber,  
 trucks and teams \_\_\_\_\_
- XIII. LOG SKIDS: Solid foundation \_\_\_\_\_ Sufficient size \_\_\_\_\_  
 Proper slope \_\_\_\_\_ Sufficient for log supply \_\_\_\_\_
- XIV. BELTS: Satisfactory guarded for safety \_\_\_\_\_ Good  
 condition \_\_\_\_\_ Lacing in good condition \_\_\_\_\_
- XV. SLABS AND EDGINGS: Economical and safe disposal \_\_\_\_\_
- XVI. LUMBER: Loaded directly on truck \_\_\_\_\_ Piled on rolls,  
 in slings or in bays \_\_\_\_\_ Piled on ground in  
 safe orderly way \_\_\_\_\_
- XVII. INSURANCE: Fire protection satisfactory \_\_\_\_\_ First aid  
 kit available \_\_\_\_\_ Operators properly  
 shielded \_\_\_\_\_

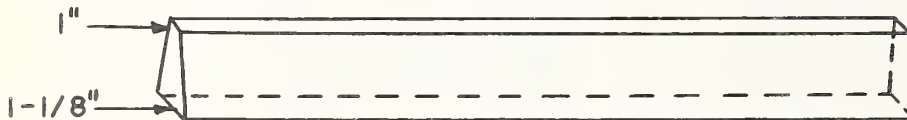
XVIII. REMARKS:

## SAWMILL LUMBER MANUFACTURE ANALYSIS

### Most Common Causes of Poorly Manufactured Lumber

- a. Improper lead in saw.
- b. Saw not filed or swaged properly.
- c. Saw not being operated at proper speed.
- d. Husk and track not level or out of line.
- e. Forcing lead in saw with guides.
- f. Set ratchet and pawl dogs worn.
- g. End play in carriage.
- h. End play in saw mandrel.
- i. Not enough headblocks to hold logs.
- j. Not dogging logs securely.
- k. Poor power.
- i. Guides loose on husk.

### Examples of Poor Manufacture



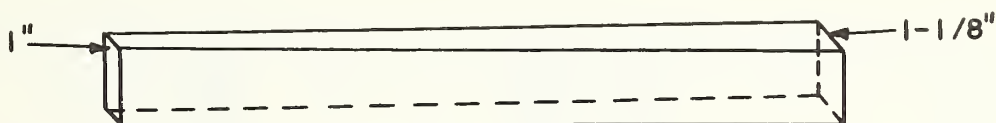
Last board on carriage, 1" top, 1-1/8" at bottom - set for 1-1/8".

- a. Causes
  - (1) Track low in front.
  - (2) Husk low next to saw.
  - (3) Bases and knees not square.



Last board on carriage, 1-1/8" top, 1" bottom, set for 1-1/8".

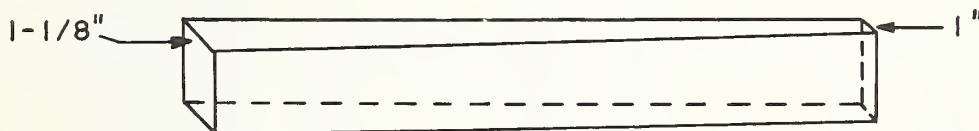
- a. Causes
  - (1) Track low on back side.
  - (2) Husk low next to pulley.
  - (3) Bases and knees not square.



Last board on carriage, 1" front end, 1-1/8" back end, set for 1".

a. Causes

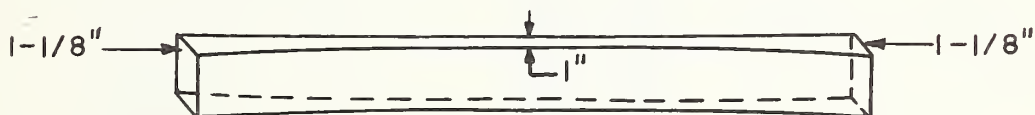
- (1) Rear knee out of line.
- (2) Board over-hanging headblock 2'-3'.
- (3) Side play in carriage.



Last board on carriage, 1-1/8" front end, 1" back end, set for 1".

a. Causes

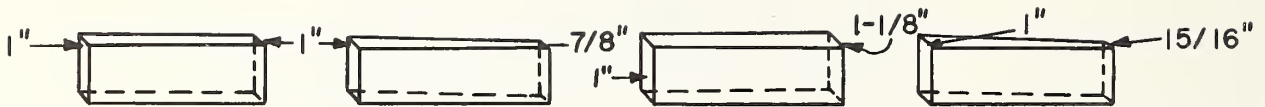
- (1) Front knee out of line.
- (2) Board over-hanging headblock 2' - 3'.
- (3) Side play in carriage.



Last board on carriage, 1-1/8" both ends, 1" at center, set for 1-1/8".

a. Causes

- (1) Crook in track next to saw.
- (2) Poor dogging.
- (3) Not enough headblocks.
- (4) Headblock out of line.
- (5) Springy log.
- (6) End play in mandrel.



Four boards same log or squared cant. Set for 1".

a. Causes

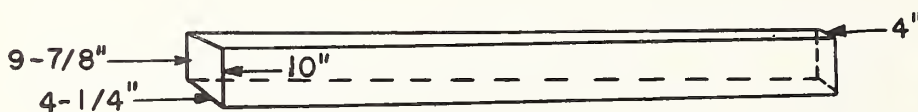
- (1) Dull saw.
- (2) Not proper lead.
- (3) Holders badly worn and not enough sawdust clearance.
- (4) Too much reduction in speed of saw in cut.



Board following slab 1" front, 1-1/8" back end. All other boards o.k.

a. Causes

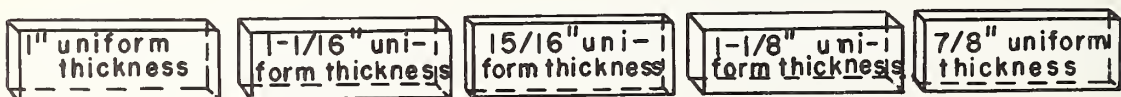
- (1) Dull corner of teeth not severing stringy inner bark and forcing saw out of cut.



Dimension stock - 10" one face, opposite face 9-7/8", one edge 4" and opposite edge 4-1/4".

a. Cause

- (1) Carriage and track not level.



Five boards from same log or squared cant. Set for 1".

a. Causes

- (1) Pawl dogs slipping.
- (2) Retaining pawls not holding.
- (3) Set ratchet worn.

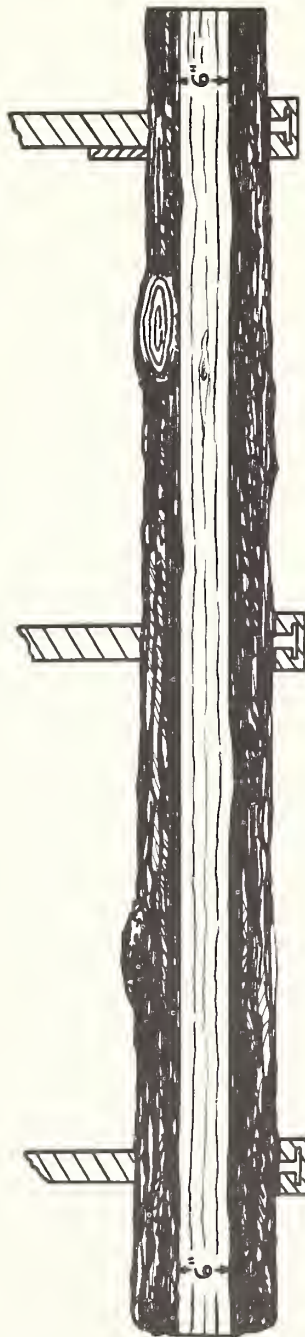
# SAWING FOR GRADE



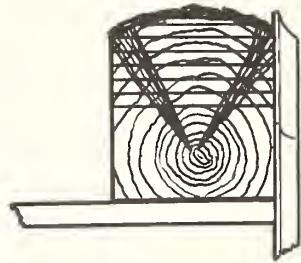
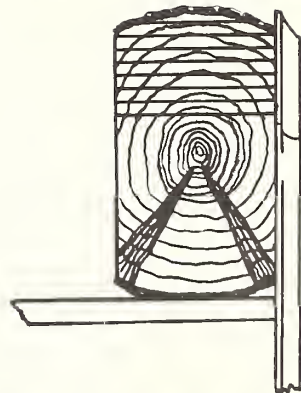
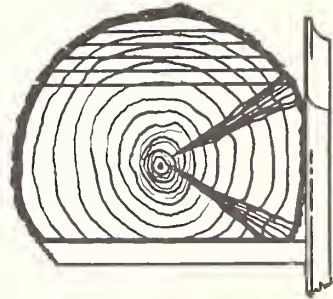
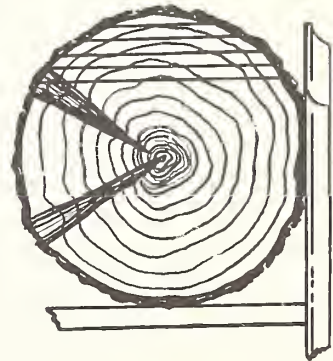
SPIKE KNOT REDUCES GRADE



ALWAYS CROSSCUT KNOTS



USE OFFSET FOR STRAGHT GRAINED BOARD



SAW BETTER FACES FIRST



X

APPENDIX



## X

## APPENDIX

## CONTROLLING THE ACCURACY OF A CRUISE

Guides to accuracy

<u>Objective</u>	<u>Accuracy</u>
Informal talk with the owner to show him the present and potential value of his woodlot.	A few well chosen plots.
To secure information sufficient to act as a guide for the general policy of handling the land.	Accuracy within 30% $\pm$
For control of cutting policy on timber sales where payment is to be made on basis of measurement of material cut.	Accuracy within 20% $\pm$
For lump sum sales based on estimated volume and for detailed management plans.	Accuracy within 10% $\pm$
For land value appraisal in extremely high value stands or species.	Accuracy within 5% $\pm$

### Determining number of plots

The following formulae allow the cruiser to determine quickly and easily the number of plots he will need to keep within the accuracy he desires. The method is based on the original work of S. R. Gevorkiantz and W. A. Duerr of the Lake States Forest Experiment Station, University Farm, St. Paul, Minnesota.

5% $\pm$ accuracy	$N = \frac{400A(f)}{A + 80(f)}$
10% $\pm$ accuracy	$N = \frac{100A(f)}{A + 20(f)}$
20% $\pm$ accuracy	$N = \frac{A \ 100(f)}{\frac{1}{4} A + 5(f)}$
30% $\pm$ accuracy	$N = \frac{10A(f)}{A + 2(f)}$

N is the NUMBER of uniformly spaced 1/5 acre plots.

A is the total area of the tract in ACRES.

f is the timber stand FACTOR (see table, following page)

### Examples:

These formulae may be easily worked mentally up to the final division, which, in itself, is simple arithmetic for the corner of a tally sheet.

Problem	(Medium stocking--patchy timber	f = 2
	(Total area in tract	62 acres
	(Degree of accuracy desired	30 $\pm$

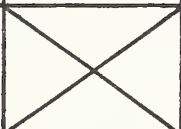
Head work     
$$N = \frac{10 \text{ times } 62 \text{ times } 2}{62 \text{ plus } (2 \text{ times } 2)} = \frac{1240}{66}$$

Division on tally sheet -

66	) 1240	19 plots required
	66	
	580	
	594	

Determining the timber-stand factor -- (f)

S T O C K I N G

	GOOD (2/3 to full) (f)	MEDIUM (1/3 to 2/3 full) (f)	POOR (less than 1/3 full) (f)
UNIFORM (less than 20% in patches)	0.2	0.6	2
AVERAGE (20% to 40% in patches)	0.4	1	3
PATCHY (40% or more in patches)		2	6

Judging stocking

The following formula may be used as a check on judgment of apparent stand stocking.

$$\text{Stocking \% (hardwoods)} = \frac{(D - 4)T}{10}$$

D is average diameter of stand.

T is number of trees per acre occupying light space in the canopy.

Judging uniformity

Uniform - appearance uniform - patches of lesser or greater density hardly apparent.

Average - general woodlot appearance - a few patches of lesser or greater density clearly apparent.

Patchy - appearance patchy - patches of less or greater density strikingly apparent.

# CALCULATING STATISTICAL ACCURACY OF COMPLETED ESTIMATE

The following formula and table enable quick calculation of the statistical accuracy of a completed estimate. The method is based on original work of S. R. Gevorkiantz and W. A. Duerr of the Lake States Forest Experiment Station, University Farm, St. Paul, Minnesota.

## Basic formula

$$E^2 = \frac{A - Na}{AN} \times (f) \quad \text{Note: Expression } Na \text{ is the total area of all plots.}$$

- E is percent of accuracy expressed as a decimal.  
 A is the total area of the tract in ACRES.  
 N is the NUMBER of sample plots.  
 a is the area of a sample plot in acres.  
 f is the timber stand FACTOR (see table - page 2)

## Examples:

	Medium stocking--patchy timber	f = 2
Problem	Total area in tract	100 acres
	Number of plots tallied	20
	Size of each sample plot	1/5 acre

Head work -

$$Na = 20 \times 1/5 \quad \text{or 4 acres total area of sample.}$$

$$E^2 = \frac{100 \text{ minus } 4 = 96}{100 \times 20 = 2000} \times (2) = \frac{96}{1000} \text{ or } .096$$

Square root on tally sheet -

$$E = \sqrt{.096}$$

3	.3	1	
3	).09	60	
	9		
61	9	60	
	61	61	

or 31% <sup>+</sup>  
accuracy

## MAPPING AND MEASURING ACREAGE

Estimating timber requires an accurate determination of the acreage in timber. For planning the cruise, the approximate total acreage must be known. For computing the total volume on the tract, the exact area must have been determined.

If possible, a map of each area to be worked should be obtained before beginning field work upon it. If neither a good map nor an aerial photograph from which a preliminary map may be traced can be obtained, map should be made in the field as the cruising progresses.

### 1. Aerial photographs

#### Making a preliminary map.

A preliminary map may be quickly made by tracing over an aerial photograph. "Traceolene" (manufactured by the Transolene Company of Barrington, Illinois) or any other transparent material may be used. Enlarged aerial photographs (8 inches to the mile) are available in Agricultural Stabilization and Conservation Committee offices. Often, the farmer has a copy which has been given to him by that office.

#### Field checking the map.

Accurate boundaries are necessary for computing condition areas. With very little scouting away from the plot line, a preliminary map made from an aerial photograph can be made into an accurate field map. The result is generally better than is ordinarily obtained by direct mapping in the field without the aid of aerial photographs and with considerably more scouting.

Actual scales of the photographs often vary from the intended standard. Accordingly, it is very important to check the actual scale of the photographs. This may be done by measuring a distance on the ground which can be picked out and scaled on the photograph. This should be near the center of the photograph, if possible, for there is always some distortion near the edge.

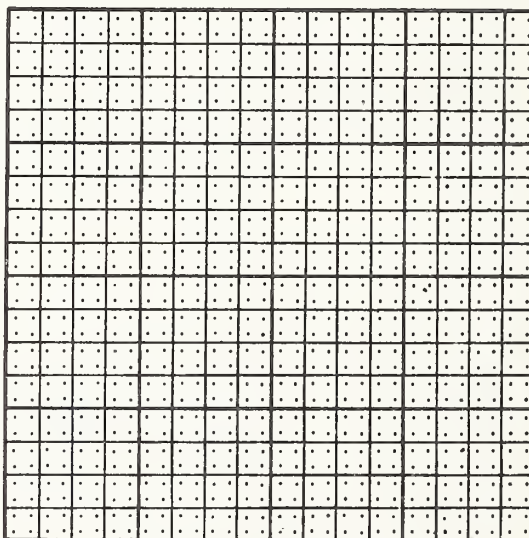
## Determining acreage.

The planimeter generally being unavailable when needed, a ruled grid and counting squares is a reliable method for scaling acreage from maps. Knowing the scale of the map, the area of the smallest square on the grid is determined. By counting the full squares and adding up the parts of squares on the type edge to make full squares, the total number of squares covering the area to be measured is determined. By multiplying the number of squares by the acreage of a single square, the total acreage is found.

This job may be done with a piece of transparent cross-section paper or with specially designed grids for which equivalent values of squares for different standard scales have been determined and listed thereon. One such grid (reduced in size) is shown.

Fractional Scale	Inches Per Mile	Acres Per Square Inch	Converting Factor Each dot equals:
1" = 7,920"	6.00	10.000	0.156 Acres
1" = 9,600"	6.60	14.692	0.230 Acres
1" = 15,840"	4.00	40.000	0.625 Acres
1" = 20,000"	3.168	63.769	0.996 Acres
1" = 31,680"	2.00	160.000	2.500 Acres
1" = 63,360"	1.00	640.000	10.000 Acres
1" = 125,000"	0.507	2,490.980	38.922 Acres
1" = 250,000"	0.253	9,963.906	155.686 Acres
1" = 500,000"	0.127	39,855.627	622.744 Acres

### MAP SCALES AND EQUIVALENTS



### MODIFIED ACREAGE GRID

(64 dots per square inch)

To be used for acreage determinations on maps of any scale.

Place grid over area to be measured; count dots, multiply by converting factor to compute total acreage. When dots fall on area boundary count alternate dots.

### BRYAN MODIFIED ACREAGE GRID\*

(Permission for reproduction and use in R-9 obtained from Milton M. Bryan)

\* Available from Forestry Suppliers, Inc., Jackson 4, Miss.

### Correction factor for odd scales.

It quite frequently happens that in using aerial photographs the scale of the map is different from the scales for which acreage equivalents are shown on the transparency. In such cases, an acreage equivalent correction factor can be figured from the known scale of the photograph as determined by field check and the scale of the acreage equivalent used.

Calculating the factor.

$$\text{Factor} = \frac{(\text{scale of acreage equivalent used})^2}{(\text{actual scale of photograph})^2}$$

Example: When the scale of the map is 6.34 inches per mile (1:10,000) and the closest scale on the grid is 6.60 inches per mile (1:9,600), what is the acreage equivalent of each dot counted?

$$\text{Factor} = \frac{(6.60)^2}{(6.34)^2} = \frac{6.60 \times 6.60}{6.34 \times 6.34} = \frac{43.56}{40.20} = 1.084$$

Acreage equivalent for scale 6.60"	.230
Factor to correct to scale 6.34"	$\times 1.084$
Acreage equivalent for scale 6.34"	<u>0.249</u>

### CUMULATIVE VOLUME TALLY SHEET

Forms 2102, 2102a, 2103, 2104 and 2105 accumulate volumes as trees are tallied and thereby enable rapid computing in the field or office. These forms are stocked by the H. Niedecken Company, 511 N. Water Street, Milwaukee, Wis. The Cumulative Volume Tally was developed at the Lake States Forest Experiment Station by J. W. Macon and S. R. Gevorkiantz. It was introduced and discussed in the Journal of Forestry in an article entitled "Estimating Volume on the Spot" in which the originators point out its advantages and its weaknesses. Although the shape and size of some editions of the sheet have been altered to fit a small size tatum holder, there has been no change in the principle as originally devised.

### Use.

The Cumulative Volume Tally Sheet is adaptable for use on many kinds of inventory surveys. It has been successfully used in making large general surveys and more intensive surveys on small woodlands. To the service forester, who by nature works with a wide variety of timber types on a

diversity of sites, the cumulative volume tally is a most useful tool; for he has not the time to make accurate volume tables for each type and site, nor often the time to compute volumes in the time-honored way if he had accurate local volume tables.

### Accuracy.

The Cumulative Volume Tally Sheet is one of the most reliable of quick methods of estimating volume. Variation from true volume amounts to less than five percent for most species, exceptions being hemlock which the cumulative volume overruns 10 to 15 percent and beech which it underruns 15 to 20 percent. Errors due to insufficient sampling, errors in judging diameters and used-heights, and misjudgment of cull percents often nullify the value of extremely accurate volume tables by introducing errors much greater than the variance error between the cumulative volume tally and actual volume for most species.

### Description.

The sheet is based on the use of a 1/5 acre circular plot (radius 52.7 feet) and a series of composite volume tables developed by the Lake States Forest Experiment Station in Technical Notes 202 and 203. The sheet is designed like a diameter and log height volume table, except that within each diameter and log height block there are numerous figures representing accumulating volumes.

### Method.

Tally trees in their corresponding dbh-used length blocks by crossing out consecutive figures. To find the board foot volume per acre (1) total the last figures crossed out in each block, (2) multiply this sum by 100 (for cordwood by 0.1) and (3) divide the product by the number of 1/5 acre plots tallied or, if plots other than 1/5 acre in size are used, by 5 times the number of acres on which tally was taken.

To obtain the actual total board foot volume (not per acre) of the trees listed on the sheet, divide the product obtained in step (2) in the paragraph above by 5. This volume may also be calculated by multiplying the sum of the last figures marked in each block--step (1) in above paragraph--by 20 (for cordwood by 0.02).

Name \_\_\_\_\_ No. \_\_\_\_\_ Date \_\_\_\_\_

Timber Type_____	Soil Type_____	Computer_____
------------------	----------------	---------------

## Growing Stock Legend

114

Good

11

## Storage

11

## Harvest

[illegible]

Above totals  $\times 100$  (for cordwood 0.1)  $\div$  No. 1/5 acre plots = Gross Volume per Acre.

Total No. Trees      ÷ Acreage in plots \_\_\_\_\_ = No. of Trees per acre (Total All Species) \_\_\_\_\_

[illegible]

Average dbh \_\_\_\_\_ Number of 1/5 Acre Plots \_\_\_\_\_ Accuracy \_\_\_\_\_ % ±

Average merchantable height \_\_\_\_\_ Number of poles per acre \_\_\_\_\_

Average growth rate, rings per inch \_\_\_\_\_ Number of saplings per acre \_\_\_\_\_

### Tallying.

In using the Cumulative Volume Tally Sheet, tallying should be done by 2 inch dbh classes (11.0 to 12.9 is the 12" dbh class, etc.) and to the closest half-log length (8'). Correct dbh and the full height usable for logs should be tallied. True diameters or usable log heights of individual trees should not be arbitrarily "docked" as a cull allowance; but, based upon the best local information obtainable, cull should be applied as a percentage deduction to the total gross volume.

### Utilization.

The minimum sawlog is 8 feet long, with not less than an 8 inch top dib. Volumes of the larger trees are taken to a point where the main trunk divides into large branches, is unsound, or otherwise unusable for sawlogs.

Use of Special Blocks on the Form.

### Legend and Cull %

A single sheet may be used for each species; or, by the use of symbols or different colors, a single tally sheet may be used for more than one species. Likewise, each class of trees may be listed separately or on a single sheet. A block is provided for listing the legend used.

### Plots Tallied

This block is provided for listing the number of plots when a single sheet is used for tallying more than one plot.

### Cull Trees

Cull trees may be tallied here. They may be listed in the diameter block at the left side of the sheet instead of in the cull tree block if it is desired to keep track of them by dbh classes.

### Near Merchantable Trees

Near merchantable trees ordinarily are considered to be the 10 inch dbh trees. If growth predictions are to be made, they should be tallied in the special block provided.

# Sample Cumulative Volume Tally Sheet - Log Scale - Mixed Hardwood

These tally forms are available for International (2102), Scribner (2103) and Doyle (2104) log scales. Sheet size to fit 5" x 9" tatum holder. A similar Form (2102a) for pine and aspen is available.

CUMULATIVE VOLUME INTERNATIONAL LOG SCALE TALLY SHEET																						
Based on Composite Volume Tables by the Lake States Forest Experiment Station -- 1943																						
FORM 2102 . . . . H. NIEDECKEN COMPANY, MILWAUKEE, WIS., PRINTED IN U. S. A.																						
NAME _____										INTERNATIONAL												
COUNTY _____										DATE _____												
STATE _____										ESTIMATOR _____												
SECTION _____ TWP. _____										RANGE _____ FORTY _____												
DBH	NUMBER OF 1/8 FOOT LOGS										VARIABLE TOP TO 8" D.I.										TOTAL B.F. PER A.	
	1/2		1		1 1/2		2		2 1/2		3		3 1/2		4							
12	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	LEGEND & CULL %	PLOTS TALLIED	CULL TREES
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38				
	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56				
	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74				
	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92				
14	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	AV. DBH	WEAR MERCH- ANTABLE TREES	
	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129				
	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147				
	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165				
	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183				
16	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202			
	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220				
	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238				
	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256				
	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274				
18	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293			
	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311				
	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329				
	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347				
	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365				
20	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384			
	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402				
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	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438				
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	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511				
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	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547				
24	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566			
	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584				
	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602				
	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620				
	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638				
26	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657			
	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675				
	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693				
	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711				
	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729				
28	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748			
	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766				
	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784				
	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802				
	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820				
30	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839			
	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857				
	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875				
	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893				
	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911				
32	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930			
	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948				
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	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984				
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34	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021			
	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039				
	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057				
	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075				
	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093				
36	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112			
	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130				
	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148				
	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166				
	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184				
38	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203			
	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221				
	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239				
	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257				
	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275				
40	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294			
	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312				
	1313	1314	1315	1316	131																	

# Sample Cumulative Volume Tally Sheet - Cordwood

Form 2105. Sheet size to fit 5" x 9" tatum holder.

CUMULATIVE VOLUME CORDWOOD TALLY SHEET																			
Based on Composite Volume Tables by the Lake States Forest Experiment Station -- 1943																			
FORM 2105 . . . M. NIEDECKEN COMPANY, MILWAUKEE, WIS., PRINTED IN U. S. A.																			
NAME _____										CORDWOOD									
COUNTY _____										DATE _____									
STATE _____										ESTIMATOR _____									
SECTION _____										TWP. _____									
RANGE _____										FORTY _____									
DBH	NUMBER OF 8 FOOT BOLTS PER TREE																Variable top to 4' dib.		TOTAL CORDS PER ACRE
	1				2				3				4				5	6	
6	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	PLOTS TALLIED
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	LEGEND & CULL %
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
10	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	NEAR MERCHANTABLE TREES
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	5
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
14	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	6
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
16	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	7
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
18	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	UNPEELED VOLUME IN TENTHS OF CORDS
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
20	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	(Reduce 15% for peeled volume)
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
22	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	NEAR MERCHANTABLE TREES
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26		
	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38		
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41		
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		

(\*) MULTIPLY the SUM of the last figures used in each block by 0.1 \*\*\* (1) For VOLUME PER ACRE divide this product by the NUMBER of 1/5 acre plots -- (2) For MARKING TALLY VOLUME divide the product from A by 5



## COMPOSITE VOLUME TABLES

One of the most outstanding developments in tools for use of service foresters is the "composite volume table". Cumulative volume tally sheets and volume table charts are based on these tables. Use of a single table for many species is based on the fact that where the same standards of utilization are employed differences in volume for most species are of no practical consequence. Errors made in width of strip, in size of plot, in missing trees, in misjudgment of usable height and in determination of tract area outweigh the slight volume variations between species.

To the International  $\frac{1}{4}$  inch kerf, Scribner and Cordwood composite volume tables, introduced in August 1943 by the Lake States Forest Experiment Station as Technical Notes 202 and 203, has been added a Doyle table made by the Lake States and checked by the Central States Forest Experiment Station. The Lake States Station has extended the tables to meet the needs of foresters using them. All of the tables are giving satisfactory results throughout the North Central Region.

Log Scale Composite Volume Tables (Hardwood)

Utilization standards: Stump height is one foot. Height is the number of usable 16-foot logs to a variable top diameter not smaller than 8 inches inside the bark.

International $\frac{1}{4}$ inch kerf log scale volume table										
Diameter breast high (Inches)	Number of 16-foot logs per tree									
	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	Volume in board feet					International Rule				
10	17	39	53	68						
12	30	57	80	100	115					
14	42	79	110	140	163	181	205			
16	59	105	147	180	213	247	278	309		
18	74	135	188	235	278	320	360	400	445	490
20	92	170	236	295	350	402	450	499	552	605
22	112	209	290	362	430	494	555	613	676	704
24	133	252	346	431	512	594	665	742	821	900
26	158	300	409	508	604	698	786	880	980	1080
28	187	348	478	597	705	812	918	1025	1137	1250
30	220	408	552	687	811	934	1061	1180	1315	1450
32	256	471	643	794	935	1077	1216	1358	1519	1680
34	292	534	730	900	1060	1222	1380	1538	1724	1910
36	330	602	820	1012	1195	1375	1555	1734	1957	2180
38	373	673	913	1130	1335	1540	1740	1942	2196	2450
40	415	744	1007	1247	1475	1703	1928	2155	2437	2720
42	462	840	1120	1390	1630	1900	2150	2400	2750	3100
44	510	930	1240	1520	1800	2100	2350	2600	2975	3350
46	555	1020	1350	1670	1990	2300	2575	2850	3250	3650
48	600	1110	1470	1800	2170	2500	2800	3100	3525	3950
50	650	1190	1590	1960	2350	2700	3050	3400	3825	4250

Scribner log scale volume table

Diameter breast high (Inches)	Number of 16-foot logs per tree									
	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	Volume in board feet					Scribner Rule				
10	14	30	40							
12	28	48	66	78	97					
14	40	70	96	116	141	165	190			
16	54	93	129	158	191	224	252	280		
18	72	122	168	207	248	292	323	355	400	445
20	90	156	212	262	317	366	407	451	502	553
22	111	194	262	328	392	452	505	563	620	678
24	137	236	319	399	472	549	613	687	754	822
26	165	281	381	478	566	653	730	820	901	982
28	195	331	448	559	665	764	857	959	1054	1150
30	227	383	522	648	772	886	995	1112	1228	1345
32	260	439	598	746	888	1019	1140	1278	1424	1570
34	294	500	678	847	1009	1159	1292	1455	1619	1783
36	330	564	767	955	1136	1307	1460	1644	1834	2025
38	365	633	855	1068	1269	1463	1638	1842	2068	2295
40	402	703	951	1183	1406	1631	1822	2052	2321	2590
42	450	790	1055	1305	1550	1800	2025	2250	2575	2900
44	485	870	1175	1435	1700	2000	2230	2460	2805	3150
46	535	950	1275	1575	1860	2190	2445	2700	3075	3450
48	575	1020	1380	1718	2025	2390	2670	2950	3350	3750
50	615	1100	1490	1870	2210	2550	2875	3200	3600	4000

Doyle log scale volume table

Diameter breast high (Inches)	Number of 16-foot logs per tree									
	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	Volume in board feet					Doyle Rule				
10	10	16	21							
12	18	29	38	46	52					
14	28	49	66	79	90	104	114			
16	42	71	98	121	142	162	176	189		
18	60	99	134	165	196	224	249	268	296	325
20	80	130	177	220	260	297	330	360	390	420
22	101	170	230	284	336	383	427	464	507	550
24	129	215	292	360	428	486	541	600	655	710
26	160	265	355	436	518	594	667	740	810	880
28	192	320	428	520	620	708	800	888	984	1080
30	228	377	507	626	738	840	949	1040	1170	1300
32	266	440	591	732	862	988	1118	1227	1363	1500
34	305	508	681	849	999	1142	1293	1430	1590	1750
36	347	581	779	970	1140	1309	1475	1641	1835	2030
38	389	661	880	1099	1292	1484	1672	1866	2083	2300
40	430	743	990	1230	1450	1665	1880	2088	2344	2600
42	470	845	1120	1380	1630	1860	2090	2320	2620	2920
44	520	950	1250	1520	1820	2080	2320	2560	2920	3280
46	570	1050	1390	1690	2040	2300	2575	2850	3250	3650
48	620	1150	1520	1850	2250	2550	2865	3180	3590	4000
50	690	1230	1650	2040	2450	2780	3140	3500	3950	4400

Pine and aspen are generally used to a smaller top diameter inside the bark than are the hardwoods. In many places, these species are used down to five or six inches in diameter on the small end of the top log. The following composite log scale volume tables were developed by the Lake States Forest Experiment Station for use in estimating stands where this closer utilization is practiced.

Log Scale Composite Volume Tables (PINE and ASPEN)

Utilization standards: Stump height is one foot. Height is the number of usable 16-foot logs to a variable top diameter not smaller than 5 or 6 inches inside the bark.

International $\frac{1}{4}$ inch kerf log scale volume table*										
Diameter breast high (Inches)	Number of 16-foot logs per tree									
	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	Volume in board feet					International Rule				
8	10	20	27	35						
10	17	35	47	58	72	83	96	110		
12	30	54	72	90	106	123	139	155	167	180
14	42	78	109	135	155	172	196	220	235	250
16	59	105	147	180	213	247	273	300	320	340
18	74	135	188	235	278	320	360	390	420	450
20	92	170	236	295	350	402	450	499	544	590
22	112	209	290	362	430	494	555	613	671	730
24	133	252	346	431	512	594	665	742	821	900
26	158	300	409	508	604	698	786	880	980	1080
28	187	348	478	597	705	812	918	1025	1137	1250
30	220	408	552	687	811	934	1061	1180	1315	1450
32	256	471	643	794	935	1077	1216	1358	1519	1680
34	292	534	730	900	1060	1222	1380	1538	1724	1910
36	330	602	820	1012	1195	1375	1555	1734	1957	2180
38	373	673	913	1130	1335	1540	1740	1942	2196	2450
40	415	744	1007	1247	1475	1703	1928	2155	2437	2720
42	462	840	1120	1390	1630	1900	2150	2400	2750	3100
44	510	930	1240	1520	1800	2100	2350	2600	2975	3350
46	555	1020	1350	1670	1990	2300	2575	2850	3250	3650
48	600	1110	1470	1800	2170	2500	2800	3100	3525	3950
50	650	1190	1590	1960	2350	2700	3050	3400	3825	4250

\* Minimum top diameter inside bark is 5 inches.

Scribner log scale volume table\*

Diameter breast high (Inches)	Number of 16-foot logs per tree									
	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	Volume in board feet					Scribner Rule				
8	7	14	19	25						
10	14	27	36	45	55	65	79	93		
12	28	45	60	74	88	102	118	135	145	155
14	40	68	85	105	128	150	170	190	200	210
16	54	93	121	155	188	215	237	260	275	290
18	72	122	168	207	248	292	323	340	367	395
20	90	156	212	262	317	366	407	440	475	510
22	111	194	262	328	392	452	505	550	600	650
24	137	236	319	399	472	549	613	685	752	820
26	165	281	381	478	566	653	730	820	901	982
28	195	331	448	559	665	764	857	959	1054	1150
30	227	383	522	648	772	886	995	1112	1228	1345
32	260	439	598	746	888	1019	1140	1278	1424	1570
34	294	500	678	847	1009	1159	1292	1455	1619	1783
36	330	564	767	955	1136	1307	1460	1644	1834	2025
38	365	633	855	1068	1269	1463	1638	1842	2068	2295
40	402	703	951	1183	1406	1631	1822	2052	2321	2590
42	450	790	1055	1305	1550	1800	2025	2250	2575	2900
44	485	870	1175	1435	1700	2000	2230	2460	2805	3150
46	535	950	1275	1575	1860	2190	2445	2700	3075	3450
48	575	1020	1380	1718	2025	2390	2670	2950	3350	3750
50	615	1100	1490	1870	2210	2550	2875	3200	3600	4000

\*Minimum top diameter inside bark is 6 inches.

Doyle log scale volume table\*

Diameter breast high (Inches)	Number of 16-foot logs per tree									
	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
	Volume in board feet					Doyle Rule				
8	2	4	6	9						
10	6	10	14	19	24	30	37	44		
12	15	23	30	39	48	57	66	75	83	92
14	27	42	55	69	84	98	109	120	130	140
16	42	69	92	115	136	155	170	185	192	200
18	60	99	130	165	195	220	242	265	272	280
20	80	130	177	220	260	297	330	360	372	385
22	101	170	230	284	336	383	427	464	492	520
24	129	215	292	360	428	486	541	600	655	710
26	160	265	355	436	518	594	667	740	810	880
28	192	320	428	520	620	708	800	888	984	1080
30	228	377	507	626	738	840	949	1040	1170	1300
32	266	440	591	732	862	988	1118	1227	1363	1500
34	305	508	681	849	999	1142	1293	1430	1590	1750
36	347	581	779	970	1140	1309	1475	1641	1835	2030
38	389	661	880	1099	1292	1484	1672	1866	2083	2300
40	430	743	990	1230	1450	1665	1880	2088	2344	2600
42	470	845	1120	1380	1630	1860	2090	2320	2620	2920
44	520	950	1250	1520	1820	2080	2320	2560	2920	3280
46	570	1050	1390	1690	2040	2300	2575	2850	3250	3650
48	620	1150	1520	1850	2250	2550	2865	3180	3590	4000
50	690	1230	1650	2040	2450	2780	3140	3500	3950	4400

\*Minimum top diameter inside bark is 6 inches.

### Species variation

Composite board foot volume tables are applicable to most tree species in the Lake and Central States. Certain species of distinctly different height, bark thickness or form class vary from these tables. Factors which may be used to more closely approximate the volume of individual species are given in the tables below. These factors are based on tests made by the Lake States Forest Experiment Station, using the standards of utilization upon which the composite volume tables are based.

In many cases the variations within the whole stand are of a compensating nature and using the variations by species will result in a very little change in total stand volume.

### Species Correction Factors for use with Composite Volume Tables

Sugar Maple	OK
Yellow Birch	OK
Hackberry	OK
Bur Oak	OK
Green and White Ash	OK
Basswood	Subtract 2%
Hickories	" 2%
Red and White Oaks	" 3%
Black Walnut	" 3%
White Pine	" 4%
Black Ash	" 5%
Paper Birch	" 7%
Post Oak	" 7%
Aspen	" 7%
Hemlock	" 8%
Jack Pine	" 10%
Northern White-Cedar	" 10%
Red Pine	Add 4%
Red Maple	" 5%
Elm	" 5%
Cottonwood	" 7%
Sycamore	" 7%
Beech	" 15%

### Cordwood Composite Volume Table

Utilization standards: Volume is stem volume above one-foot stump in standard unpeeled cords.\* Height is number of usable 8-foot bolts to a variable top diameter not less than 4 inches inside the bark.

### Cordwood Volume Table (applicable to all species except cedar)

D B H	Used height in number of 8-foot bolts							
	1	2	3	4	5	6	7	8
	:	:	:	:	:	:	:	:
Inches	Volume in cords							
6	.02	.03	.04	.06				
8	.03	.05	.07	.09	.12	.14		
10	.05	.07	.10	.13	.17	.20	.24	.27
12	.07	.10	.14	.18	.22	.27	.32	.36
14	.10	.13	.18	.23	.29	.35	.42	.47
16	.12	.17	.22	.29	.36	.44	.52	.59
18	.15	.20	.27	.35	.44	.53	.63	.72
20	.18	.25	.32	.42	.52	.63	.76	.85
22	.22	.29	.38	.49	.61	.74	.88	1.00

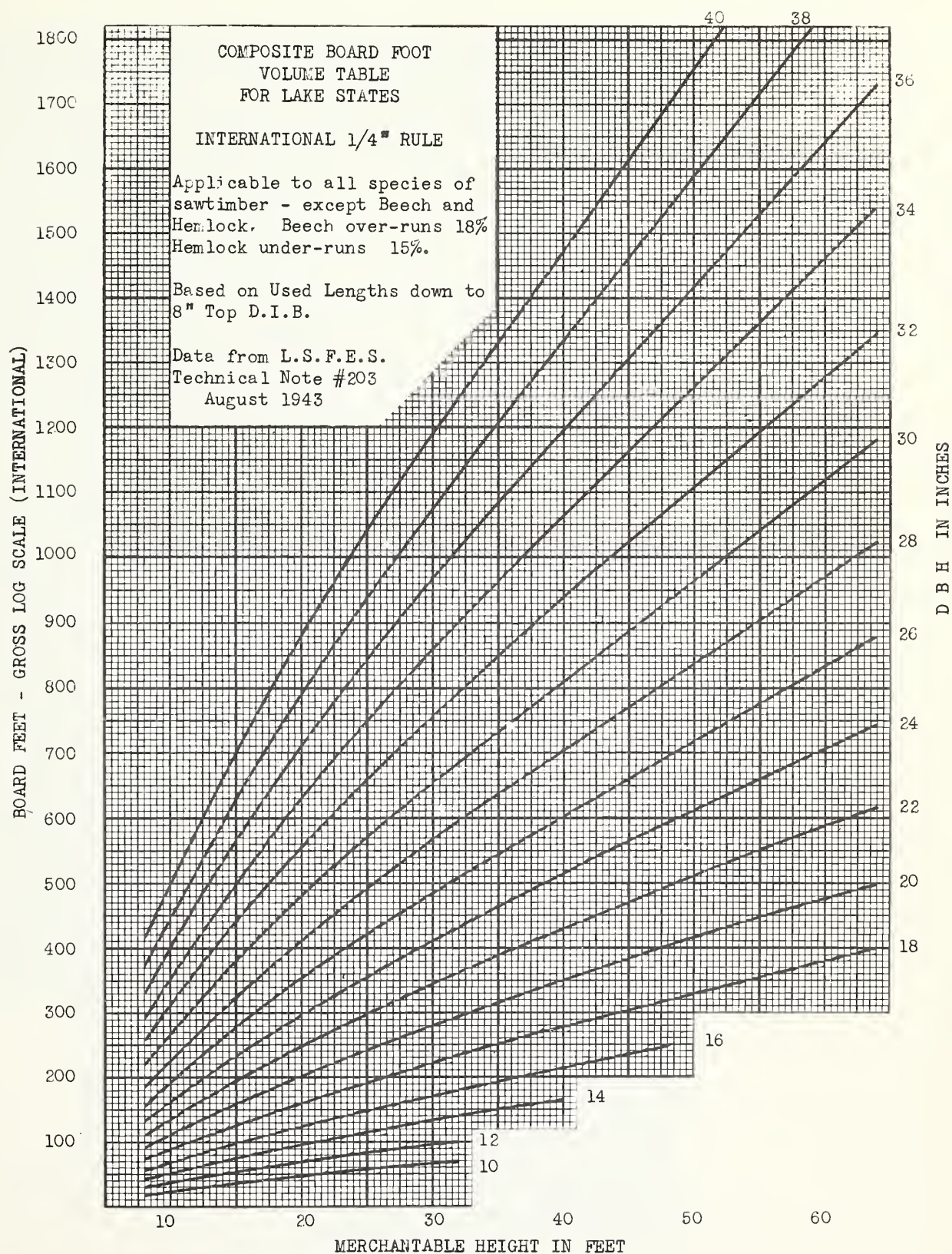
\*Standard cord is 4' x 4' x 8'. To find approximate peeled volume, subtract 12 percent.

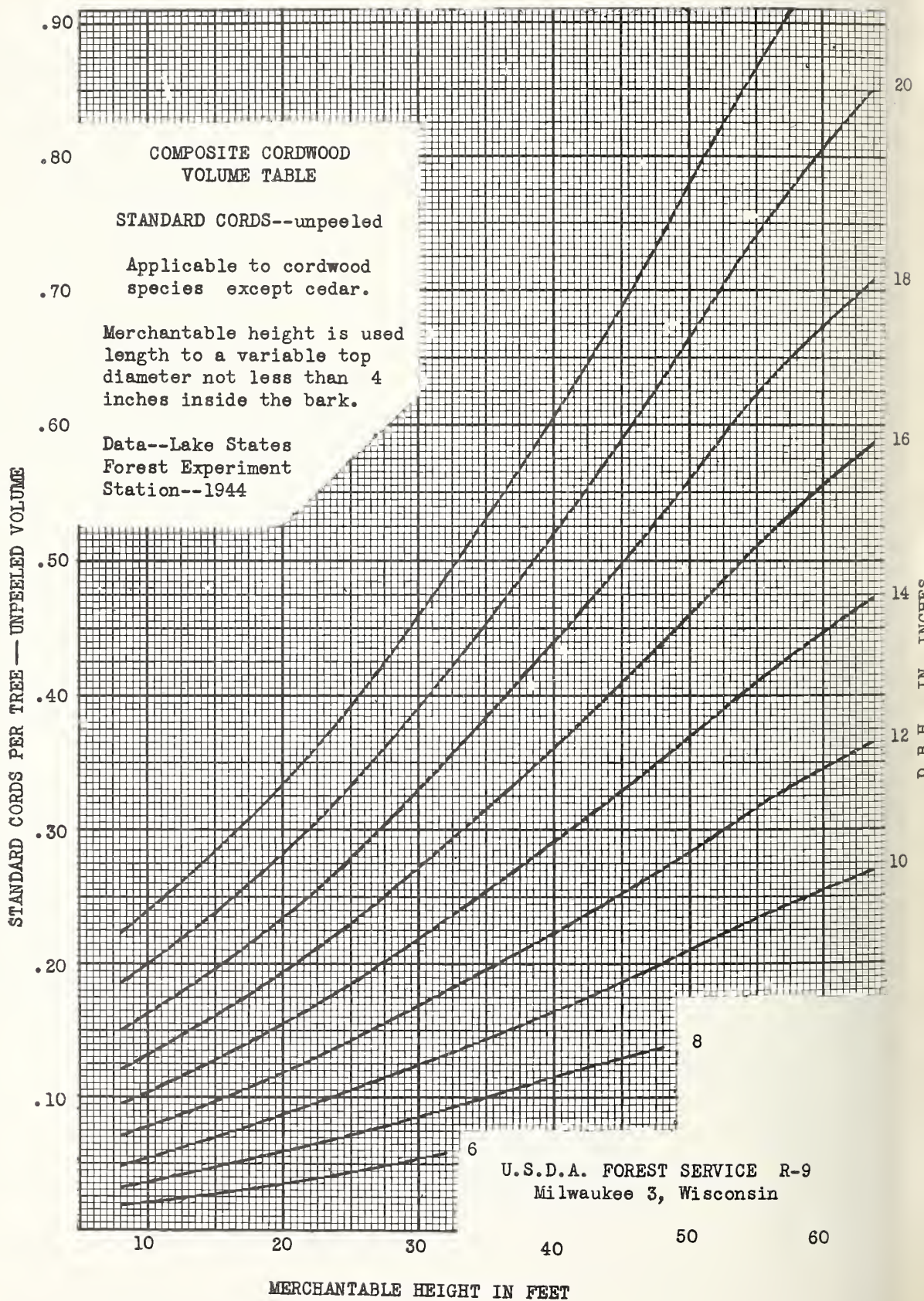
### VOLUME TABLE CHARTS

Volume table charts are volume tables platted by dbh classes with volume over used height. By making it possible to quickly derive a dbh volume table adapted to local conditions, these charts save considerable time when many plots are to be estimated.

How to use the volume table chart.

1. When cruising by diameters only, obtain a series of sample used heights from mechanically selected trees. This may be done by estimating the usable length on the two trees nearest the center of the plot or at even spaced distances on a strip line.
2. Average the merchantable lengths by dbh classes.
3. Plot these average merchantable lengths on the corresponding dbh line shown on the chart.
4. Draw a smooth curve through these points.
5. Read the volume for each dbh class where the smooth curve crosses the dbh line.





### THE CULL IN HARDWOOD AND CONIFEROUS TREES

Volume tables listed previously give gross volumes before applying cull deductions. Net volumes may be determined by the application of local cull factors.

Lacking local data on cull over the wide area for which this tool kit is intended to be used, the following average cull percentages may be used as guides when converting gross volumes to net. It will undoubtedly be desirable to adjust these factors on the basis of local observation and experience.

Guiding Cull Percentages for Commercial Trees 11" and Larger in the Total Stand. Central States and Southern part of Lake States.\*

#### Cull in Old Growth Stands

10%	15%	20%
Ash (white)	Ash (black)	Ash (blue)
Cottonwood	Catalpa	" (green)
Gum (red)	Cherry (black)	Basswood
Hickory (shag.)	Elm (slippery)	Birch (river)
Honeylocust	" (American)	Buckeye
Oak (bur)	Hackberry	Butternut
" (sw. white)	Hickory (other)	Magnolia
" (white)	Maple (red)	Maple (silver)
Sycamore	Oak (chestnut)	" (sugar)
Walnut (blk.)	" (chinkapin)	Oak (black)
Yellow-poplar	" (northern red)	" (pin)
Oak (overcup)		" (scarlet)

25%	35%
Oak (post)	Beech
Sassafras	Oak (blackjack)
Willow	
Blackgum	

\* - Includes mill and woods cull, but not cull trees.

### Cull in Second Growth Stands

5%	10%	15%	20%
Ash (white)	Ash (black)	Basswood	Beech
Cottonwood	Ash (blue)	Blackgum	Oak (blackjack)
Sweetgum	Ash (green)	Oak (black)	Willow (blk.)
Hickory (shag.)	Aspen	Oak (post)	
Ky. coffeetree	Basswood	Oak (scarlet)	
Honeylocust	Birch (river)	Magnolia	
Oak (bur)	Buckeye	Oak (pin)	
" (chestnut)	Butternut		
" (sw. white)	Catalpa		
" (white)	Cherry (wild bl.)		
Sycamore	Elm (slippery)		
Walnut (black)	Elm (American)	* - Includes mill and woods cull, but not cull trees.	
Yellow-poplar	Hackberry		
Shortleaf pine	Hickory (other)		
Red cedar	Maples		
	Oak (chinkapin)		
	Oak (red)		

### RULES OF THUMB USEFUL IN CRUISING

The Three Halves Rule: - This rule is a means of quickly checking the volume being marked for cutting in terms of a percent of total volume of the stand. The rule can be used for controlling the volume being marked in the cut and leave cruise as well as in the actual marking job.

1. For the cut and leave cruise the total number of trees tallied is recorded and the percentage of trees tallied for cutting is figured. This percentage of trees, multiplied by 1.5 will give roughly the percentage of the total net volume which is to be cut when Scribner Log Scale is used. If International Log Scale is used, multiply the percentage of trees by 1.3 instead of 1.5. If Doyle Log Scale is used multiply by 1.4.
2. For the actual marking job it is necessary to obtain the total number of trees in the stand, either by making a tally of the trees which are not marked, or by keeping track of the acreage which has been marked and multiplying it by the total number of trees per acre, as shown by the cut and leave cruise previously made. The latter is usually the most practical way. The percentage of trees marked for cutting can then be figured and the rule applied the same as for the cut and leave cruise.

The Eight, Seven, Six Rule: - This rule, derived from Girard Form Class taper tables for hardwoods, is used as a guide in estimating diameters of hardwood logs in the standing tree at the top of each 14 to 16 foot log.

D.I.B. Top of	Estimated Pro- portion of D.B.H.
1st 16' log	80%
2nd " "	70%
3rd " "	60%

Example dbh = 20" x .8 - 16" dib at 14 to 16' above stump  
 20" x .7 - 14" dib at 30 to 32' " "  
 20" x .6 - 12" dib at 46 to 48' " "

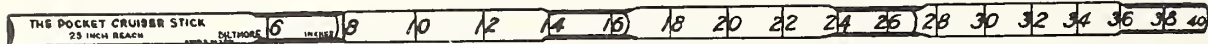
\*Tree Spacing Guide: - A rule of thumb is to thin so that the average space in feet between two stems equals their average diameter at breast height in inches, plus six. Thus two healthy trees 10 and 6 inches in diameter would have an average diameter of 8 inches. Converting to feet and adding 6 gives 14 feet as the proper distance between trees. These spacings are usually designed to let the owner cut over his entire woodland once every five years.

Generally, not more than one-quarter of the wood volume is taken out at any one thinning.

These rules are no substitute for common sense. A clump of 8 or 10 good trees with room on the outside, but crowded in the center, might be thinned to 2 or 3 according to the rule. Actually, wise selection and cutting of 3 trees might give the whole group enough room. In short, each tree should be sized up individually for its chances of growing into profitable timber.

## How to Use the Pocket Cruiser Stick

### Biltmore Stick



Like any other Biltmore stick the pocket cruiser stick is held horizontally against the bark of the tree at  $4\frac{1}{2}$  ft. from the ground. The eye is "held" 25 inches from the point where the stick and tree are in contact. The stick is shifted until the line of sight to the bark edge on the left hand side of the tree and the end of the rule line up. The diameter of the tree is read at a point on the rule in line with the bark edge on the right side of the tree.

The chief sources of error in using a Biltmore stick are incorrect distance of eye from the point where the stick rests on bark of tree, and moving the head when reading the rule.

### Hypsometer - Dendrometer



This is a modification of the Merritt type of hypsometer. It consists of a 24-inch rule. When held vertically 25" from the eye with bottom of stick at ground line and eye at 25 feet from the tree, each inch on the rule represents one foot on the length of the tree. At 50 feet from the tree each inch represents 2 feet; at 75 feet from the tree, 3 feet, etc. If you take about 25 to 26 steps to the chain, 10 steps is 25 feet. Unless you have an exceptionally long or short step, it is generally close enough in using the stick to pace 10, 20 or 30 steps from the tree for 25, 50, 75 feet, etc.

There are many pitfalls in using the Merritt type of hypsometer. To get a usable reading, the height must be measured from a point at right angles to any lean in the tree; the stick must be 25 inches from the eye, and must be held truly vertical; and the paced distance must be reasonably correct.

Theoretically the dendrometer scale is perfect. If the eye is 25 feet from the tree and the stick is held correctly at 25" from the eye, with any tree lean at right angles to line of sight, and the proper marks for the height at which the reading is desired is used, the reading will be good. Carelessness can make the stick read poorly. This denrometer is not a research instrument any more than are the Biltmore and Merritt Hypsometer scales, but it can be useful for checking judgment if carefully used.

Generally, the dendrometer will be used at the position from which usable length is measured and will be used primarily to help judge the position of the minimum diameter limit to which the stem will be utilized.

In each inch block on the hypsometer-dendrometer side of the stick, marks indicate widths representing 3, 6, 9 and 12 inches at the far end of slant length for that height above the eye in feet.

#### How to Use the Denrometer Scale:

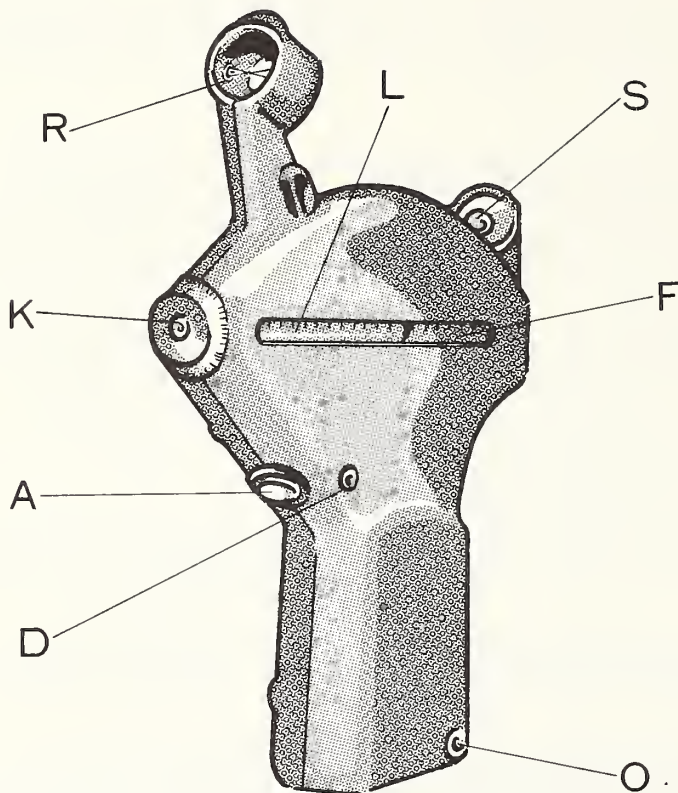
- (1) Estimate the height above your eye to the point at which the diameter is to be measured.
- (2) Use the denrometer scale marks opposite the figure for this height.
- (3) At a position 25 feet from the tree, hold the stick horizontally 25 inches from the eye and sight across the dendrometer scale to the point on the tree for which the diameter is to be measured.
- (4) With the left side of the tree at the zero end of the denrometer scale observe where the right side of the tree falls and read the apparent diameter to the nearest inch.

If the work is done carefully, measurement should be close enough to prevent a major error in judgment.

#### Note

Errors are liable to occur in the results obtained from the use of measuring instruments. Many of these errors are not the fault of the instrument. Poor results in using instruments such as the cruiser stick are due chiefly to unnecessary carelessness of the operator.

## 2. The Haga Altimeter



The measurement should be made at a distance from the tree approximately equal to its height. This distance should be equal to, or a multiple of, one of the ranges (L) obtained by turning knob (K). The pointer should be released by pressing button (D) at the side of the case. The altimeter is then held firmly by the butt with the forefinger on the trigger (A) and directed at the merchantable top of the tree. It is important that the altimeter be held in an upright position. Sight through the pinhole in the eye-piece (S) until the tips of the front-sight prongs (R) coincide with the merchantable top of the tree. When the needle has come to rest, the trigger (A) is pressed to lock the needle. The height of the object above eye-level can then be read off the scale (F). A second sight is then taken at the stump height. The sum of the two readings is the merchantable height of the tree.

## LUMBER GRADES

1. Lumber grade recovery

The following lumber grade recovery tables based on a woods and mill scale study at Trout Creek, Michigan in which lumber was graded by the Von Platten--Fox lumber grader, illustrates the effect of log size and grade on lumber grade.

SUGAR MAPLE LUMBER GRADE RECOVERY FOR158 GRADE I LOGS

Top D.I.B. of log	Bd.ft. of Lumber	Lumber grades in percent							
		FAS	Sel.	#1 Com.	#2 Com.	#3a Com.	#3a Com. Ties*	#3b Com.	#3a & 3b Com. Comb.
9									
10									
11									
12	1489	5.2	9.0	19.6	13.5	5.1	22.0	25.6	52.7
13	2466	8.4	9.2	21.0	12.3	4.9	21.9	22.3	49.1
14	3373	11.4	10.0	22.6	11.2	4.8	21.7	18.3	44.8
15	3947	14.5	10.5	24.2	10.1	4.6	20.7	15.4	40.7
16	3841	16.9	11.2	26.1	9.4	4.4	18.8	13.2	36.4
17	2097	18.0	12.1	27.9	8.6	4.0	15.9	13.5	33.4
18	2912	18.5	13.1	29.9	7.8	3.5	13.0	14.2	30.7
19	1392	18.5	14.3	31.9	7.1	3.0	10.1	15.1	28.6
20	807	18.5	15.5	33.9	6.6	2.4	7.1	16.0	25.5
21	326	18.6	16.6	35.5	6.2	1.8	4.0	17.3	23.1
22	535	18.6	17.8	37.1	5.9	1.2	1.0	18.4	20.6
23	352	18.6	19.0	38.3	5.8	0.5	.0	17.8	18.3
24	None	18.7	20.0	38.9	5.6	.0	.0	16.8	16.8
Total									
Bd.ft.	23537	3439	2718	6152	2274	970	4067	3917	8954
Av.%	100	14.61	11.55	26.14	9.66	4.12	17.28	16.64	38.04
No. 1 com. and better-		52.30%		No. 2 com. & poorer		47.70%		38.04%	

\* Includes side lumber and 126 ties converted to 4-4 No. 3a common lumber.

## SUGAR MAPLE LUMBER GRADE RECOVERY FOR

## 320 GRADE II LOGS

Top D.I.B. of log	Bd.ft. of Lumber	Lumber grades in percent							
		FAS	Sel.	#1 Com.	#2 Com.	#3a Com.	#3a Com. Ties*	#3b Com.	#3a & 3b Com. Comb.
9									
10	1658	1.9	3.9	10.6	11.1	6.4	32.4	33.7	72.5
11	5263	2.7	4.4	14.8	12.0	6.3	28.1	31.7	66.1
12	3883	3.8	5.0	18.0	13.0	6.2	24.2	29.8	60.2
13	4776	4.9	5.7	20.7	13.7	6.2	20.7	28.1	55.0
14	4011	5.9	6.3	22.2	14.4	6.1	18.5	26.6	51.2
15	4252	7.0	7.1	22.8	14.9	6.1	16.0	26.1	48.2
16	3112	8.1	7.9	23.4	15.3	6.2	13.1	26.0	45.3
17	2668	8.9	8.6	23.7	15.7	6.3	10.4	26.4	43.1
18	1218	9.1	9.4	23.9	16.3	6.4	8.1	26.8	41.3
19	399	9.4	9.9	24.0	16.9	6.5	5.7	27.6	39.8
20	246	9.7	10.5	24.1	17.1	6.6	3.7	28.3	39.6
21	671	9.7	11.2	24.2	17.6	6.7	1.5	29.1	37.3
22	-	9.8	11.8	24.2	17.8	6.7	0	29.7	36.4
23	-	9.8	11.8	24.2	18.0	6.2	0	30.0	36.2
24	-	9.8	11.9	24.2	18.0	5.7	0	30.4	36.1
Total									
Bd.ft.	32157	1816	2048	6471	4507	2005	6192	9118	17315
Av. %	100.00	5.65	6.37	20.12	14.01	6.23	19.26	28.36	53.85
No. 1 Common and Better - 32.14% No. 2 Com. & Poorer - 67.86% 53.85%									

\*Includes side lumber and 187 ties converted to 4-4 No. 3a common lumber.

## STANDARD HARDWOOD LUMBER GRADING

## DEFINITION OF STANDARD TERMS

- SM - - - - - Surface Measure in square feet. Multiply width of board in inches by length in feet and divide the product by 12.
- Unit - - - - - Twelve square inches of board surface. It is used to determine whether or not a board has enough clear surface to make a certain grade. To find the number of units in a cutting, multiply its width in inches by its length in feet.
- Cutting - - - - - A part of a board that can be obtained by cross cutting, ripping, or both. The part (or cutting) is not less than the minimum dimensions specified for each grade.
- Clear face cutting - A cutting with 1 clear face and reverse side sound.
- Sound face cutting - A cutting free from rot, pith, shake, and wane. Admits sound knots; sound bird pecks, stain and streaks; pin, shot and spot worm-holes; and season checks not impairing the strength of the cutting. On reverse side of cutting, two 1/4" holes or one 1/2" hole admitted to each 12 units (144 square inches).

## PROGRESSIVE STEPS IN GRADING LUMBER BY STANDARD RULES

1. Determine species.
2. Determine poor side of board.  
(Boards are ordinarily graded from the poor side.)
3. Any mis-manufacture apparent?
4. Assume grade of board.
5. Determine the Surface Measure.
6. Calculate needed Units.
7. Calculate permitted cuttings.
8. Check assumed grade.
9. Correct when necessary.
10. Tally SM by grade and thickness.

STANDARD HARDWOOD LUMBER GRADES<sup>o</sup>

LUMBER GRADE (1)	SMALLEST BOARD PERMITTED (2)	SPECIAL RULES (3)	CLEAR SURFACE REQUIRED		CLEAR FACE CUTTINGS	
			% (4)	No. of UNITS (5)	MAXIMUM NUMBER PERMITTED <sup>oo</sup> (6)	MINIMUM SIZE PERMITTED (7)
FIRSTS	6" by 8'	Aggregate length of boxed or showing <u>PITH</u> in inches not over SM in feet.  <u>WANE</u> in aggregate not over 1/12 of board surface, nor more than 1/2 length of either edge.	91 $\frac{2}{3}$	SM X 11	SM $\div$ 5, (but not over 3)	4" by 5' 3" by 7'
SECONDS		<u>SPLIT</u> in inches not over 2 X SM in feet, nor divergent more than 1 inch in 1 foot. (In end foot governed by End Foot rule.)	83 $\frac{1}{3}$	SM X 10	SM $\div$ 4, (but not over 4)	
SELECTS	4" by 6'	<u>END FOOT</u> must be 75% free from wane or rot, with at least 50% clear surface in not more than 2 pieces.  Average diameter of any <u>KNOT OR HOLE</u> in inches not over 1/3 SM in feet.  (Selects only) <u>REVERSE SIDE</u> of 4" and 5" boards sound edged (permits wane up to 1/3 length, width and thickness.)	91 $\frac{2}{3}$	SM X 11	One for boards with 2' to 3' SM.	
		For boards with 4' SM or more, one face SECONDS with reverse side of cuttings sound or reverse side of board grading No. 1 Common.				
No. 1 C.	3" by 4'	Aggregate length of boxed or showing <u>PITH</u> not over 1/2 the length of the board.	66 $\frac{2}{3}$	SM X 8	(SM + 1) $\div$ 3, (but not over 5)	4" by 2' 3" by 3'
No. 2 C.		No restriction as to <u>PITH</u> when outside the required cutting area.	50	SM X 6	SM $\div$ 2, (but not over 7)	3" by 2'
No. 3A C.		No restrictions.	33 $\frac{1}{3}$	SM X 4	Unlimited	
No. 3B C.			25	SM X 3	Unlimited sound cuttings	1 $\frac{1}{2}$ " wide with at least 36 sq. in.

<sup>o</sup>National Hardwood Lumber Manufacturers Association, Chicago, Illinois.

<sup>oo</sup>When quotient is less than a whole number throw the calculated number of cuttings down.

(Special Cases Over)

LUMBER GRADE	CLEAR SURFACE REQUIRED		GREATEST NUMBER OF CUTTINGS PERMITTED
	%	UNITS	
SECONDS	$91\frac{2}{3}$	SM X 11	$(SM \div 4) + 1$ cuttings for boards with 6' to 15' SM
No. 1 Common	100	SM X 12	Both faces clear for boards with 1' SM
	75	SM X 9	1 cutting for boards with 2' SM, or $(\frac{SM + 1}{3}) + 1$ cuttings for boards 3' to 7' SM
No. 2 Common	$66\frac{2}{3}$	SM X 8	1 cutting for boards with 1' SM, or $(SM \div 2) + 1$ cuttings for boards with 2' to 7' SM

## PRINCIPAL SPECIES AND GRADES REQUIRING STANDARD LUMBER INSPECTION

SPECIES <sup>o</sup>	FIRSTS	SECONDS	SELECTS	No. 1 C.	No. 2 C.	No. 3A C.	No. 3B C.
ASH BEECH BIRCH HARD (SUGAR) MAPLE RED ALDER HACKBERRY CABINET ROCK ELM CABINET HICKORY CABINET PECAN							
RED OAK (A) WHITE OAK (A) LOCUST (A)	Standard except: 3/4 of one face to be heartwood.						
BASSWOOD (A) SOFT ELM (B) SOFT MAPLE BOX ELDER BUCKEYE SAP GUM (C) COTTONWOOD (C) BLACK GUM (C) TUPELO (C) MAGNOLIA (C) WILLOW (C) ASPEN (C)							
ROCK (CORK) ELM (B) HICKORY (B) PECAN (B)							

(A)--Mineral and similar streaks and spots admitted in aggregate area up to 1/12 surface area of required cuttings. If in excess, reduce piece 1 grade. (FAS considered here as a single combined grade.)

(B)--Bird pecks up to 3/8" average diameter admitted in aggregate area up to 1/12 surface area of required cuttings. If in excess, reduce piece 1 grade. (FAS considered here as a single combined grade.)

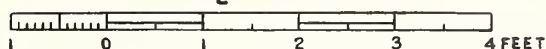
(C)--Stain admitted in cuttings in all grades.

<sup>o</sup>For the special rules applying to RED GUM, CHERRY, POPLAR, WALNUT and BUTTERNUT consult the measurement and inspection rule book of the National Hardwood Lumber Association, Chicago, Illinois.

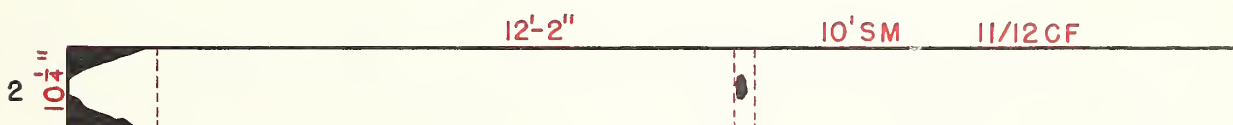
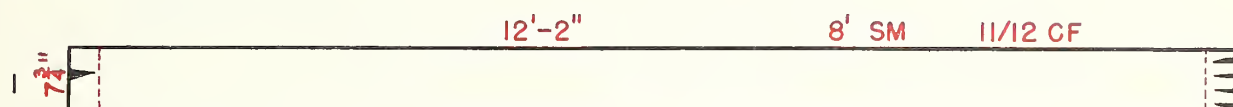
# LUMBER GRADING CHART

SM SURFACE MEASURE  
CF CLEAR FACE  
SF SOUND FACE

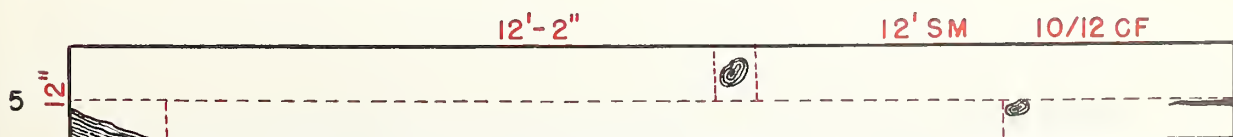
SCALE:  $\frac{1}{2}$  INCH = 1 FOOT

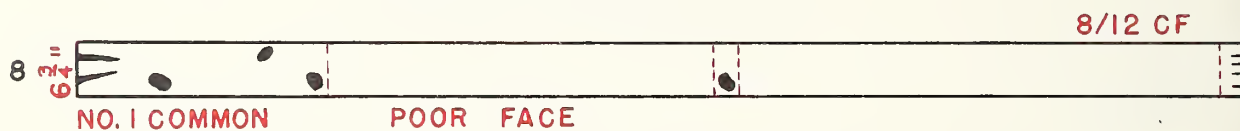
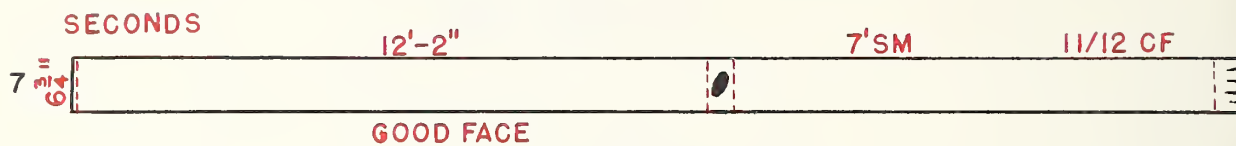
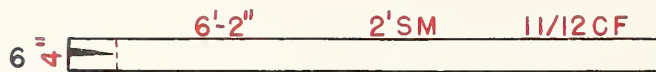


## FIRSTS

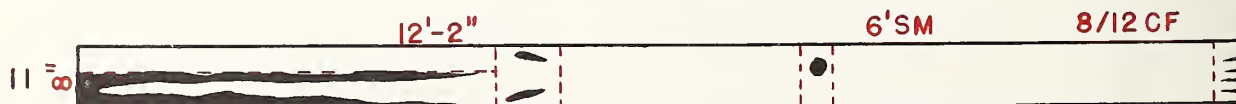


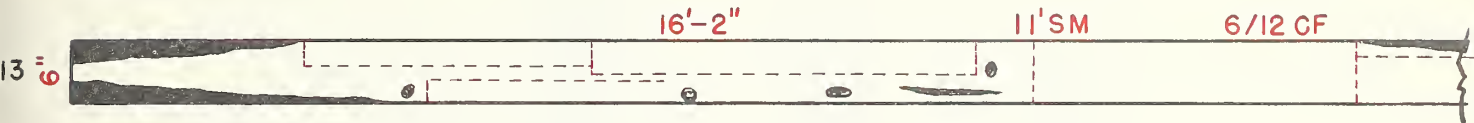
## SECONDS



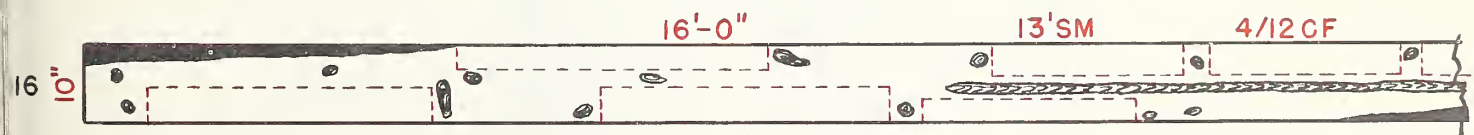
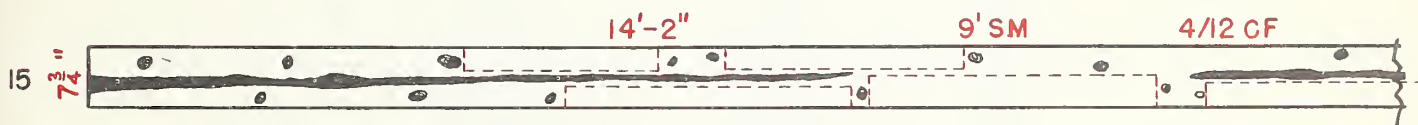


NUMBER 1 COMMON





3A



3 B



## ACCOMPLISHMENT REPORT COOPERATIVE FOREST MANAGEMENT

Project \_\_\_\_\_ State \_\_\_\_\_ For month of \_\_\_\_\_

Number of man-months project has been operated—Total \_\_\_\_\_ Current F. Y. \_\_\_\_\_ By incumbent \_\_\_\_\_

KIND OF WORK DONE	CURRENT MONTH	FISCAL YEAR 19_____
1. Requests for service..... number		
a. Requests for service not yet acted on..... number		x x x x x x x x
2. Forest products operators advised..... number		
a. Operators not previously assisted (new cases)..... number		
3. Owners given woodland management assistance..... number		
a. Woodland involved..... acres		
b. Timber marked for cutting..... M b. ft.		
Timber marked for cutting..... cords		
Woodland involved..... acres		
c. Timber inventoried for management plan..... M b. ft.		
Timber inventoried for management plan..... cords		
Woodland involved..... acres		
d. Owners not previously assisted (new cases)..... number		
4. Woodlands on which improved practices are being followed..... number		
a. Commercial timber cut..... acres		
b. Forest stand improvement..... acres		
c. Young timber saved from premature harvest..... acres		
d. Land planted..... acres		
e. Woodland placed under protection from fire..... acres		
f. Woodland placed under protection from grazing..... acres		
g. Woodland placed under wildlife management..... acres		
h. Improved sugar bush operations..... acres		
i. Improved gum farming operations..... number		
j. Woodland pruned..... acres		
5. Estimate of forest products harvested under improved cutting practices:		
a. Sawlogs, lumber, veneer logs or blocks..... M b. ft.		
b. Pulpwood..... 128 cu. ft. standard cords		
c. Poles, piling, and drive posts..... number		
d. Crossties..... number		
e. Fuel wood, sugar wood, tobacco wood..... standard cords		
f. Fence posts..... number		
g. Miscellaneous products (converted to standard cords).....		
h. Total products ("a" to "g" inclusive) converted to M b. ft.....		
i. Crude gum..... bbl.		
j. Maple syrup..... gal.		
k. Christmas trees, holly, nuts, etc. (value)..... dol.		
6. Estimate of forest products harvested without benefit of improved cutting practices—marketing assistance only (do not include in item 5 above).....		
7. Total forest products harvested (items 5h+6)..... M b. ft.		
8. Approximate stumpage returns to woodland owners..... dol.		
9. Approximate gross returns to woodland owners..... dol.		
10. Cooperation with private practicing foresters:		
a. Woodland owners referred to above..... number		
b. Woodland involved..... acres		

## INSTRUCTIONS

1. Report is due on or before \_\_\_\_\_ of each month.
2. No cover letter of transmittal is necessary.
3. Show under "Total" the number of man-months project has been operated since beginning.
4. The "Fiscal Year" column starts from "Zero" on July 1 of each fiscal year and is the accumulation of the "Current Month" figures.

**The following comments refer to items as numbered on the face of the form:**

1. Show only new requests received during the current month. Show the accumulated total of all requests received during the year in the "Fiscal Year" column whether serviced or not.
- 1a. Show all unserviced requests that require a visit to the operators' woods or mill operation or to the landowners' woodland. This will not be limited to those requests received during the current month (1 above) but should include all requests still pending and unserviced.
2. Show forest products operators and processors advised or assisted on woods or mill operations, both new and repeat cases.
- 2a. Show only new cases included in "2" above.
3. Show number of landowners given all types of advice and assistance in woodland management, both *new* and *repeat cases*. Return trips to the same owner's woodland for the purpose of giving additional advice or assistance on a new management problem or in connection with the use or sale of a different product should be reported in the "Current Month" column each time this additional service is given. Show in the "Fiscal Year" column the accumulated total of all owners advised or assisted, both *new* and *repeat cases*.
- 3a. Include all woodland acreage on which any type of management advice and assistance is given regardless of whether or not it is necessary to mark or otherwise designate timber for cutting.
- 3b. Include only volumes and areas actually marked or otherwise designated for cutting. Convert poles, piling, veneer logs, and ties to thousand feet board measure. Convert small products to standard cords (128 cubic feet).
- 3c. Include only volumes and areas actually inventoried for management plan purposes. Convert poles, piling, veneer logs, and ties to thousand feet board measure. Convert small products to standard cords (128 cubic feet).
- 3d. Show only new cases included in "3" above. Do not include any repeat cases in "Current Month" or "Fiscal Year" columns.
4. Use only items that apply to project area.
- 4a. Include areas cut according to selective marking and also areas where diameter limit or seed-tree cutting is raised above ordinary practice.
- 4b. Ordinarily little or no cash return—home use. Will include cutting, not strictly improvement in nature, where quality trees are selected for building or repair. Include improvement with chemicals and prescribed burning.
- 4c. Initial or intensified fire protection resulting from forester's efforts; include prescribed burning.
5. Include products harvested, both sale and home use, where advice on silvicultural practice has resulted in improved cutting.
6. Convert all products to M b. ft.
7. Self-explanatory.
8. Include stumpage values only.
9. Include stumpage value plus any additional return to owner from his own labor, hauling, and supervision (gross returns).
10. Self-explanatory.

Give brief statement covering difficult problems, unusual or interesting cases, and work not covered by statistical statement. Use additional sheet if necessary.

Signed \_\_\_\_\_  
Forester.

Date \_\_\_\_\_

## FOREST MANAGEMENT ASSISTANCE PROGRAMS

ESTABLISHED PROGRAMS						NEW PROGRAMS	
LAW	Clarke-McNary 1924 Section 4 (CM-4)	Cooperative Forest Manage- ment Act - 1950 (CFM)	Agricultural Conservation Program - 1938 (ACP)	Watershed Pro- tection and Flood Prevention Act. P. L. 566 1954	Blister Rust Control Lee Act 1940	Forest Pest Control Act P. L. 110 1947	AGRICULTURAL ACT OF 1956  Title I-Soil Bank Subtitle B. Conservation Reserve  Farm crop land Idle forest land  Assists states in a program of tree plant- ing to build up and main- tain a level of timber growing stock
TYPE OF LAND	State and private lands	All private lands	All private lands and state lands	Private and Public Lands within Watershed. Technical	All Ownerships Federal, State, Private.	State and Private	Assists states in a program of tree plant- ing to build up and main- tain a level of timber growing stock
PURPOSE	Production and distribution of forest seed and tree plant- ing stock for forests and windbreaks	Provides for technical service to small woodland owners and primary proces- sors of forest products.	To establish plantations and shelterbelts, woodland improve- ment and pro- tection.	Assistance in applying land treatment measures for protection of the watershed.	Accomplish and maintain control of Blister Rust in all worth- while White Pine stands.	Provide for protection of forests against major forest pests, other than Blister Rust.	To protect the national soil, water, forest, and wildlife resources from waste and depletion.
MAXIMUM BENEFITS AUTHORIZED	Cost-sharing Federal - 50% State - 50% (State required) to match fed- eral funds)	Cost-sharing Federal - 50% State - 50% (State required) to match fed- eral funds)	Cost-sharing Federal - 80% Landowner - 20%	Cost-sharing Federal - 50% State - 50% For technical assistance only. (States required to match Federal Funds.)	Cost-sharing Cooperative on State and Private Lands. Federal Cooperative Funds to be matched at least 50%. On U. S. Lands 100% federal.	Cost-sharing Approximately Federal - 2% State and Private - 7%	Cost-sharing ** Federal - 80% Landowner - 20% Other Benefits Federal payment to landowner for annual rental of Land in Conser- vation Reserve for period 10-15 years.
SPECIFIC ASSISTANCE TO LANDOWNER	Provides tree planting stock at cost.	1. Provides technical services in woodland management. 2. Provides technical services to primary proc- essors of for- est products.	1. Cost sharing for conserva- tion practices. a. Tree plant- ing b. Timber stand improvement c. Fencing d. Clearing for tree planting	Technical assistance in woodland manage- ment within the approved watershed.	On all lands, Forest Service furnishes leader- ship, technical direction, coordination; on State and Private lands owners furnish labor.	Receive assis- tance from state and federal sources in con- ducting forest pest control operations.	1. Technical assistance for tree planting. 2. Financial assistance for tree planting.
AGENCIES RESPONSI- BLE FOR ADMINIS- TRATION	State Forester in cooperation with the Forest Service.	State Forester in cooperation with the Forest Service and State Forester.	State Forester in cooperation with Forest Service and Soil Conservation Service.	Forest Service in cooperation with State Agencies.	State Forester or designated agency, in co- operation with U.S. Forest Service.	State Forester in cooperation with the Forest Service and State Forester. ***	State Forester in cooperation with the Forest Service

\* Proposed

\* For establishing only

\* Through State and County ASC Committees

Prepared by the Division of State and Private Forestry,  
Office, Forest Service, Milwaukee, Wisconsin. November

Regional Office, Forest Service, Milwaukee, Wisconsin. November 1, 1956

REGION 9 SUPPLEMENTAL INSTRUCTIONS FOR PREPARATION OFFORM C.F.M.-1General

These instructions are prepared to supplement those on the printed form in order to provide for uniform interpretation of the items in Region 9. It is recognized that it would be difficult to cover all possible cases and conditions. In cases that are not specifically covered by instructions it is expected that the state will issue instructions based on its best judgment tempered by the general principle that the form is intended to show the kind and amount of work for which the service forester is responsible. The following explanations serve as a guide to proper entries for the items indicated.

Due Date

This report is due in the Regional Office of the Forest Service on or before the 5th of each month.

Number of man-months project has been operated - Total

This is the total number of man-months the project has been in operation with a forester on the job. It is cumulative from the date the project was initiated. Project boundaries are sometimes changed but unless the change involves 50% or more of the area, the project should be considered the same.

Current month and Fiscal Year columns

These columns provide spaces for entering the amount of work by kind of work done. All figures from the "current month" column are accumulated in the "fiscal year" column. The fiscal year referred to runs from July 1 to the following June 30. The June report therefore gives the total amount of work done for the fiscal year. If there is no figure to be entered on any line, a zero (0) should be inserted. This will insure that figures get on the proper line and that no entry is overlooked.

The report will be completely closed on June 30 each year, with the exception of item 1-a. This item will be carried over to the new report. Recurring cases previously closed will be recorded as new cases.

The following instructions apply to the numbered items on Form CFM-1 (Revised Feb. 1956):-

1. Include all bona-fide requests received for advice and assistance in the management of forest lands, including insect and disease infestations, and the harvesting, marketing and processing of forest products. Shade tree and horticultural requests should not be entered.
  - 1a. This figure will be the number of requests not yet acted on (item 1a) of the previous month, plus the requests received during the current month (item 1), less the requests handled during the month. Records should show the disposition of each request. In arriving at this figure for a July report at the start of a new fiscal year, the figure on the June report for the preceeding fiscal year should be considered. There may be some unserved requests carried over from the past fiscal year that should be used in computing the figure for the July report.
2. Show only technical advice and assistance to an operator on some phase of his operation, such as cutting, logging, mill operation, equipment, manufacturing techniques, plant efficiency, etc. If the forester actually locates a market for the operator's product, or actually locates stumpage or logs for the operator, enter here. Include all visits to operators for the purpose of giving advice or assistance.
  - 2a. This means "new" for the current fiscal year. Same operators may have received advice or assistance during prior years. Show each individual only once during any one fiscal year. This will give the number of individual operators advised or assisted during the fiscal year.
3. Show all landowners visited for the purpose of giving advice or assistance on some separate management or marketing problem. This will give the number of jobs worked on or completed during the current month and fiscal year. Timber operators who have requested forest management assistance on woodland which they own should be reported as landowners under this item.
  - 3a. Show all woodland and planting acreage involved in advice and assistance given and included under item 3. Show each acreage only once within each fiscal year, since this item is set up to show the total acreage on which all types of advice or assistance have been given.

- 3b. Record the acreage and volume marked by the service forester, or under his direction. Include only marking for which the service forester is responsible. Marking done by industry foresters or consulting foresters should not be included. However, see instructions under items 4 and 5. Report board foot volumes only to the nearest thousand.
- 3c. Not to be interpreted as implying Forest Service approval of inventories, cruises or volume determinations for purposes of liquidation. It applies to inventories for management plan purposes only.

In states where the service foresters are authorized to assist landowners with trespass cases, inventories or cruises for trespass cases may be included.

If fuelwood from tops or culls is to be used, cord volumes of same may be entered here. If not to be utilized, do not record cordage. Do not record cordage volume in pole size material unless it is to be utilized for fuel or chemical wood. In this case consider only the harvest material in pole size. Good growing stock in pole size is expected to be left to mature.

- 3d. This means new during current fiscal year. Count each individual only once. This will give the number of individual landowners advised or assisted during the month and fiscal year.
- 4. Record only the number of woodlands, for "new" cases during the fiscal year, on which one or more of the actions listed in 4a to j has been taken. Woodlands turned over to industry or consultant foresters by the service foresters for marking, on which the cutting was field checked and considered acceptable by the service forester, may be included. Acreage figures under items 4a to j may be duplicated from month to month during the fiscal year.
- 4b. This includes timber stand improvement work such as thinning, cutting, girdling or otherwise eradicating cull, poorly formed, or undesirable species, where no products are sold. Include non-commercial cuttings, such as fuelwood, posts, barn material and maintenance lumber for home-use.

- 4c. Report areas of young timber which owner intended to cut but decided to save, on recommendation of the forester.
- 4d. Self-explanatory.
- 4e. Some definite action such as construction of a fire-break or purchase of tools or equipment must be taken by the owner.
- 4f. Some definite new action, such as fencing of pastures, or restriction of stock must be taken.
- 4g. Requires definite action by owner to improve game habitat, such as planting or special cutting for openings, etc.
- 4h. Self-explanatory.
- 4i. Not applicable.
- 4j. Self-explanatory.
- 5. Show products harvested from areas reported under 4a, and the home-use products under 4b. Include volume cut from areas marked by industry or consultant foresters on which cutting was checked and considered acceptable by the service forester if he is responsible for the improved cutting practice.
  - 5a. Round off figures to nearest thousand board feet. Do not report fractions or decimals.
  - 5b. Self-explanatory.
  - 5c. Include mine props, caps, etc.
  - 5d. Self-explanatory.
  - 5e. Self-explanatory.
  - 5f. Self-explanatory.
  - 5g. For products cut which are not listed in 5a through 5f.
  - 5h. Use converting factors previously furnished by the regional office of the U. S. Forest Service. Copies are usually contained in your management handbook.

- 5i. Not applicable.
- 5j. Self-explanatory.
- 5k. Self-explanatory.
- 6. Report volume of timber (converted to M.B.F.) on which marketing assistance only was given. This includes cases where the timber was marked and then the owner disregarded the forester's recommendations and sold everything, taking advantage of the marketing assistance. It also includes those cases where the owner just requests assistance in marketing his timber. While the policy is not to assist owners who just want to make a sale and not practice good management, there are cases where an owner has a legitimate marketing problem and can be helped by the service forester.
- 7. Self-explanatory.
- 8. Record dollar value (nearest dollar) of stumpage return to owner when timber is cut. Include value of all items reported on line 7.
- 9. Value of stumpage plus any net returns added by owner's work, such as cutting, skidding, hauling, etc. Exclude cash paid out of pocket by owner. This figure should be equal to or greater than that shown in item 8 for any one entry.
- 10. This refers to consultant foresters only. Do not include cases turned over to industry foresters for marking. Such cases may be shown as a footnote if desired.

#### Narrative Report

Give a brief description of one or more interesting or unusual cases showing how owner or operator was assisted, results achieved, new ideas, etc. Outstanding cases are often suitable for publication in the "American Forests" or other magazines. They should be submitted in accordance with the rules and regulations in your state. The Regional Office would appreciate copies quarterly.



